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TRANSMISSION OF ENERGY FROM THE COAL MINE.

The proposition to use low-grade or refuse coal as a source of energy to be transmitted to any available market dates back to the very beginning of electric energy transmission, but the plan proposed has seldom been carried into practice. There are very few plants of this character in the world, so that any addition to the list is of special significance. Such a plant is that of the Maritime Railway & Power Company, of Amherst, Nova Scotia, situated at the very mouth of the Chignecto mine, which has long been worked for export purposes as well as for domestic use. When coal falls below a certain grade it ceases to be profitable to mine it for shipment involving added cost for transportation. Hence the possible advantage of shipping the electricity, so to speak, at low cost instead of trying to transport the coal.

The source of energy in the plant described in this issue is the slack and culm derived chiefly from the poorer seams of the mine. The plant, started some five years ago, has gradually grown until now it is a profitable and useful source of energy distributed over a considerable area, including six municipalities. The fuel is decidedly poor, containing up to 30 per cent of ash and clinker and showing under boiler test an evaporation of only about 6¼ lb. of water per pound of coal. Nevertheless, the fuel has proved very useful when burned at the pit mouth.

The generating plant has been designed for serviceability and moderate cost rather than with the intention to provide it with the refinements which are fundamentally adapted merely to save fuel. The steam generating plant consists of eight boilers of the return tubular form, giving about 150 lb. pressure. The steam is utilized in a pair of vertical cross-compound condensing engines, each directly coupled to a three-phase generator. Although such engines are not generally rated as giving the highest feasible economy in energy generation, yet they do remarkably well considering the conditions of operation, consuming about 14 lb. of steam per indicated hp.-hour at and near rated full load. The local distribution of energy is accomplished at 2200 volts, and the distribution to neighboring territory at 11,000 volts, energy being transmitted to the principal centers of distribution over two independent pole lines. Several mines and quarries are served by the transmission system. The connected load rises to some 900 hp in motors and 500 kw in lamps. The plant runs twenty-four hours per day, the total number of men employed being ten in two shifts. Owing to the considerable motor load the load-factor even for the twenty-four-hour run is high, being about 70 per cent. Altogether the plant is an excellent example of utilization of waste fuel, an example that deserves to be followed in not a few localities in this country.

VECTOR REPRESENTATION OF ALTERNATING-CURRENT PHENOMENA.

In the solution of problems relating to alternating-current phenomena the method in almost universal use is one involving vector diagrams of one kind or another. Even when the algebraic method is employed, the equivalents of vector diagrams are usually either plotted for assistance in following the treatment or held in mind for this purpose by both the reader and the writer. It will be appreciated, therefore, that a knowledge of vector diagrams is highly desirable, if not essential, on the part of one who wishes to become familiar with alternating-current workings. A simplified treatment of the more complex features of this subject is given in an article by Mr. Albert A. Nims in this issue. After describing the methods of representation of current and voltage by revolving circles or lines traveling clockwise or counter-clockwise, the author develops a method of representing power by non-rotative vectors similar in final results to the method described by Dr. A. E. Kennelly at the 1910 convention of the A. I. E. E. The simplicity of the method is its most prominent feature. It should prove as useful as it is simple.

CONCRETE POLES.

The increasing scarcity of timber and the accompanying increase in cost have for some time past compelled engineers to look about for suitable substitutes. For many purposes steel and concrete have long since replaced the weaker and less durable wood. For poles, however, both for transmission lines and for telegraph lines, wood is still extensively used and concrete is comparatively scarce. Elsewhere in this issue appears a timely article by Mr. Alfred Still on the use of reinforced-concrete poles, which brings out clearly the many advantages of concrete and at the same time shows how rapidly its use is now increasing. There is probably little doubt in the minds of engineers as to the desirability of using either steel or concrete poles in place of wood, as soon as it becomes economically possible to do so. The principal objection is the increased first cost of steel or concrete as compared with wood. Whether, in the future, this cost can be reduced to the present price of wood, the future alone can show, but at the present time it appears improbable. A second objection which has been found to concrete poles is their increased weight as compared with either wood or steel. A solid concrete pole weighs probably three times as much as one of wood of the same strength, and a hollow pole about twice as much. This, of course, increases the cost of transportation and handling.

When ultimate costs are considered, however, the concrete pole, with its greater strength and lower maintenance cost as compared with either wood or steel, appears to be the logical successor of the wooden pole. An essential feature intimately connected with the use of concrete poles is that they should be designed as carefully and even more conservatively than steel poles would be. Concrete poles have been built which after a short time in service developed unsightly cracks, and which under tests proved to have considerably less strength than wooden poles of the same size. The knowledge which a series of tests would give us to show how closely the behavior of concrete poles agreed with their theoretical behavior would be of extreme value, for the strength depends not only upon the materials but also upon the care with which they are placed in position. In this connection it is of interest to know that one of our Eastern railroad companies is now conducting a series of tests on concrete poles of various types and designs, with the idea of replacing some of the wooden telegraph poles along its right-of-way with concrete.

The relative merits of building poles at the site as compared with constructing them in a well-equipped central plant will depend, of course, upon conditions varying with each location and upon the number required. When the poles are built at the site there is a choice between constructing them flat on the ground or vertically in place. In a hollow pole, in which the reinforcing rods with their accompanying bands or rings take up a large proportion of the comparatively thin concrete shell, the difficulty in pouring concrete into the top of the vertical form, without causing objectionable voids and a possible separation of the stone from the cement, becomes considerable. It is a question whether even the use of very fine stone and a very wet mixture will reduce this difficulty sufficiently to warrant making hollow poles vertically.

THE ILLUMINATING ENGINEERING SOCIETY'S PROBLEM.

In view of the rather extended discussion at the recent Illuminating Engineering Society convention on matters of financial policy and the support of the society, a few words as to the past and prospective work of this organization are in order. This society differs from some others in the engineering field because it brings together men from such widely different fields of daily activity. At one extreme are purely scientific men engaged in research, and at the other extreme are central-station solicitors, contractors and salesmen who work altogether with the appliances and methods furnished to them by the manufacturers and experts. Between these extremes are the engineers and experts who are taking the results obtained in research by the physicist, the psychologist and the physiologist and applying them to the design of illuminating appliances and the engineering of installations. These latter form the connecting link between the purely scientific investigators and the purely commercial men who are desirous of giving the best results to their customers. One natural result of such diversity of membership is that the commercial men at one end of the line do not always appreciate the ultimate practical importance of the investigations reported by their scientific friends at the other end of the line. On the other hand, the papers which appeal to the purely commercial practical man, giving simply certain rules of design or descriptions of successful installations, do not appeal to more technical men. Then there is another element in the society, although perhaps not so great in numbers as it should be, which considers lighting mainly from the artistic viewpoint. Now, this is a very desirable combination of interests for producing practical results in the improvement of illumination. However, such a varied membership has prevented the society from receiving the financial support which it might have received had it become more

closely identified with some one set of commercial interests. Yet the results of society work in the aggregate are of far more value to the manufacturers of electric-lighting appliances, the companies which supply gas and electric service and the general public than to the individual members.

The Illuminating Engineering Society in its six years of existence has rendered great assistance to the electric public-service companies of this country. This assistance first came in the shape of information on to how to utilize light to the best advantage, in order to produce the highest measured efficiency and compete with other illuminants. Some of this help came directly and some through manufacturers of electric appliances who altered their designs to conform with economical practice. Illuminating engineers are now giving their attention to the design of installations which will be the most comfortable to work under and secure the highest working efficiency for the eyes of the users, because the recent advances in the efficiency of lighting appliances have made the cost of electric service entirely secondary to the more important considerations of human health and efficiency. The upshot of the whole matter is that the Illuminating Engineering Society has been conducting important work with very little direct financial support from those who profit most by its results. The society is face to face with either a hampering of important work through lack of funds or a change of financial policy which will permit contributions to its support by the manufacturing and central-station interests which profit by its work. Steps are to be taken to alter the constitution to provide for such support, and it is inconceivable that manufacturing and central-station interests will allow this important work to languish for lack of it.

THE LONDON RADIO-TELEGRAPHIC CONVENTION.

The convention and regulations signed by the delegates of the various nations in attendance at the London Radiotelegraphic Congress show a number of steps in advance of the position taken by the Berlin convention of 1906. It is, nevertheless, greatly to be regretted that so many archaic customs in the transmission and delivery of radiograms are not only authorized but practically forced into use by their statement in the new convention. Such matters as the absolute precedence of emergency calls and the adoption of a uniform distress signal, the prohibition of unnecessary transmission, insistence upon intercommunication, licensing of stations and of operators and the requirement of auxiliary equipment for emergency signaling can hardly fail to meet with complete support. In contradistinction, however, the specific prohibition of the use for public service of wave-lengths between 600 and 1600 meters, the stipulation that all ship communication shall be on either 300 or 600 meters wave-length (with the possible use of 1800 meters for long-distance transmission) and the cumbersome form of sending messages would seem likely not only to work an extreme hardship upon corporations engaged in commercial radio-transmission but also to bring about a considerable decrease in service efficiency.

Since the *Titanic* disaster there has been much agitation toward securing a strict legislative regulation of radio-signaling. Points which really needed attention and remedy, such as the inability of the usual ship installation to transmit when the engine-room equipment was damaged and the fact that nearly all ships put out to sea carrying only one operator, wer. brought out. However, as is usual when we find a situation which has deserved attention for some time but has received none, the matter of regulation seems to have been rather overdone in the zealous endeavor to prevent recurrence of the circumstances in the days immediately following the accident, when no news could be obtained by wireless.

The Senate and House bills proposed shortly after the United States ratified the Berlin convention, which were tremendously influenced by the popular outcry against the "failure of the wireless," provided for everything that could be considered a remedy in any sense. Had the more radical of these become laws it is difficult to see how there would have been any public radio-telegraph at all. Fortunately for the art and its development, the radio-communication act approved last month and taking effect on Dec. 13 next is somewhat less rabid than were others, although it is based almost directly on the Berlin convention. This new wireless law relieved the strict provisions made at Berlin in much the same way as was done at the London conference, and so stands more nearly in agreement with the new convention than it does with that of six years ago. It would appear that the effect of what is perhaps the worst feature of the regulations adopted at London has been tempered, for the new law does not insist upon all ship-message traffic being conducted upon either 300 or 600 meters wave-length, but states that, in addition to a designated normal wave-length, stations may use other waves, provided that they are less than 600 meters or more than 1600 meters in length. Had not this choice of wave-lengths been permitted it is probable that great confusion would have arisen wherever a large number of ships came together, for all would have been "on the same wire," so to speak. Nevertheless, what is said to be a tremendous obstacle in effective ship-to-ship and ship-to-shore transmission still remains in both the London convention and the radio-communication act; this is the restriction for government use of the entire middle range of wave-lengths.

The fundamental wave-lengths of ship antennas average about 400 meters, with extreme points about 150 meters above and below. Modern transmitters operate efficiently at wave-lengths from about one and one-fifth to say four times the natural wave-length of the antenna used and give best results at about two and a half times this. Therefore, the working ranges of wave-lengths for small, average and large ships are 300-1000, 480-1600 and 660-2200 meters respectively. Since it is considered impossible to transmit with good efficiency at wave-lengths below the antenna fundamental, it is very evident that in prohibiting the range between 600 and 1600 meters the government has effectually prevented ship-to-ship and ship-to-shore signaling under the best conditions. This is without regard to the effect of atmospheric absorption, which causes remarkably rapid attenuation when wave-lengths less than 800 meters are used and so increases the difficulties of transmission with short waves.

FREE LECTURES ON ELECTRICAL ENGINEERING IN BROOKLYN.

The department of electricity of the Brooklyn Institute of Arts and Sciences announces a series of five lectures by Dr. A. E. Kennelly, of Harvard University, on the elements of hyperbolic functions and their applications to electrical engineering. The lectures, which will be illustrated by lantern slides, are free to the profession and will be given on the second Thursday evening of each month of the season in the physics lecture room of the Polytechnic Institute, 99 Livingston Street, Brooklyn, at 8:15. A working acquaintance with ordinary circular functions of plane trigonometry will be assumed, but no calculus or mathematics above algebra will be involved. The dates and subjects of the lectures are as follows: Oct. 10, hyperbolic angles: their properties and applications; Nov. 14, the behavior of direct-current lines of uniform linear conductor resistance and dielectric conductance, in the steady state, as simplified by the use of hyperbolic functions; artificial lines and equivalent circuits; Dec. 12, the behavior of alternating-current lines of uniform linear conductor-impedance and dielectric admittance, in the steady state, and also in simple unsteady states, as simplified by the use of hyperbolic functions; Jan. 9, the application of hyperbolic functions to long alternating-current power-transmission lines; Feb. 13, the application of hyperbolic functions to telephone lines, loaded and unloaded, single and composite.

PROGRAM OF ELECTRIC VEHICLE CONVENTION.

As previously announced in our columns, the third annual convention of the Electric Vehicle Association of America will be held in Boston, Mass., on Oct. 8-9. The meetings will take place in Paul Revere Hall, Mechanics' Building, where the Boston Electric Show will then be in progress. The Electric Show will contain an electric-vehicle department, and a portion of the basement will be arranged to represent a modern electric garage in active operation.

The program which has been arranged for Tuesday, the first day, after the president's address, reports of committees, the consideration of other regular business and the election of officers, is as follows: "Where We Stand Today," by Mr. C. E. Michel, Union Electric Light & Power Company, St. Louis, Mo.; "Street and Traffic Conditions as Applied to the Use of Electric Vehicles," by Mr. R. McAllister Lloyd, International Motor Company, New York City; "The Publicity Campaign of Electric Vehicle Association of America," by Mr. Frank W. Smith, United Electric Light & Power Company, New York City; "The West as a Field for Electric Vehicles," by Dr. M. Ekstromer, Denver Gas & Electric Light Company, Denver, Colo.; "Notes on the Cost of Motor Trucks," by Dr. Harold Pender and Mr. H. F. Thompson, Massachusetts Institute of Technology, Boston, Mass., and "Some Recent Developments in the Lead Battery," by Mr. Bruce Ford, Electric Storage Battery Company, Philadelphia, Pa.

The pre-arranged program for Wednesday, the second day, is as follows: "Electric Vehicle Development in the East," by Mr. Stephen J. Thompson, Public Service Electric Company, Newark, N. J.; "Electric Vehicle Charging Apparatus," by Mr. R. E. Russell, General Electric Company, Schenectady, N. Y.; "Progress of Commercial Cars in America with Special Reference to the Electric," by Mr. E. S. Foljambe, *Commercial Car Journal*, Philadelphia, Pa.; "Insurance from the Standpoint of Electric Vehicles," by Mr. Carl H. Clark, Field & Cowles, insurance, Boston, Mass.; "The Edison Storage Battery in Service," by Mr. H. H. Smith, Edison Storage Battery Company, Orange, N. J., and "Electric Vehicle Service," by Mr. J. C. Ford, National Electric Lamp Association, Cleveland, Ohio.

A registration fee of $1 will be charged for guests and non-members, payable at the convention headquarters at the time of registration. Delegates and invited guests upon receipt of registration cards will be provided with buttons bearing the emblem of the association, which will secure for them all the privileges of the convention. The Edison Electric Illuminating Company has extended an invitation to all those attending the convention to visit the Electric Show, and those bearing the association button will be admitted on Oct. 8, 9 and 10.

THE ELECTRIC VEHICLE AT BOSTON.

The fall campaign of the Electric Vehicle Club of Boston was inaugurated at a meeting last week at the Hotel Thorndike, about 60 members and guests being present. President Day Baker reviewed the work accomplished by the club during the past season and touched upon the bright outlook for the future which has resulted from the exploitation of electric truck and passenger vehicle service under the auspices of the Boston Edison company. Vice-President Mansfield announced that in the past four months thirty-three electric passenger cars and twenty-seven commercial electric vehicles have been registered at the office of the Massachusetts Highway Commission. He stated that the Boston Edison company has under consideration the reduction of rates for electric-vehicle charging which will materially help the trade in competing with gasoline. Mr. L. D. Gibbs, Edison Electric Illuminating Company of Boston, described the preparations for the Boston 1912 Electric Show, at which a large model garage will be in service. The electric-vehicle exhibit will be more extensive than at any previous show. Among the other speakers were Messrs. A. P. Bouguardez, F. D. Emery, J. S. Codman and Converse D. Marsh.

HYDROELECTRIC ENERGY AT PITTSBURGH.

According to plans of the Clarion River Power Company, which it is said will be carried out next spring energy will be transmitted to Pittsburgh, 50 miles from a hydroelectric plant on the Clarion River. The plans include the construction of two dams, one at the mouth of the river and the other about 35 miles upstream. The first dam is to be 259 ft. high and 1200 ft. long. At a point where the first artificial lake ends the other dam will be constructed. This dam will be 265 ft. high and about 1400 ft. long. It will produce a storage reservoir 40 miles long. It is stated that the drainage area will be 25,000 acres and that 200,000 hp can be developed. The estimated cost is between $15,000,000 and $20,000,000.

THIRD INTERNATIONAL RUBBER EXHIBITION.

On Sept. 23 the third international rubber and allied trades exhibition was thrown open to the public in the New Grand Central Palace, New York City. The exhibition will be open until Oct. 3. One hundred and thirty-four exhibitors are included in the entries, representing the various rubber-producing countries of the world and numerous manufacturers and fabricators of rubber products. Among the many interesting exhibits there are several of rubber-making machinery and many of rubber products of all kinds. The exhibits of several of the rubber-producing countries are extensive and deserving of careful examination. In connection with the rubber exhibition the American Museum of Safety has a large exhibit showing safety devices adopted in a number of leading industries.

THE DUNDEE MEETING OF THE BRITISH ASSOCIATION.

The British Association for the Advancement of Science held its eighty-second annual meeting in the city of Dundee, Scotland, from Sept. 4 to 11. It is forty-five years since an association meeting was held in that city. The meeting was very successful from various points of view. The total membership enrolled was large—some 2400. The papers read were about 330 in number, distributed among twelve sections, and many were of especial interest. The schedule provided an average of 27.5 papers or discussions per section and continued for five working mornings, papers not being read in the afternoons or evenings. Moreover, both Saturday and Sunday were passed over without work, so that a week was assigned to the assimilation and discussion of less than thirty papers per section. The distribution of papers was by no means uniform, and the largest share—forty-seven papers—fell to Section A, the section of mathematical and physical science. This section found it desirable to divide itself into two parallel subsections for part of the sessions. Three evening discourses, including the presidential address, were attended, very largely, by the association as a whole. The remaining afternoons and evenings of the week were given to receptions, excursions and social events.

From the standpoint of engineering, interest centered in the proceedings both of the mathematico-physical section, A, and of the engineering section, G. In Section A the address of President Callendar, which was a plea for the restoration of caloric in the theory of heat, as a material entity to replace the abstract conception of entropy, represented a remarkable instance of a recent intellectual change shared by heat and electricity. We all know that in the days of Franklin there was much debate between the double-fluid and single-fluid theories of electricity. All electricians, however, then agreed upon a hypothesis of some kind of electric fluid or fluids. After the development of the voltaic cell, these notions concerning an imponderable hypothetical fluid fell into desuetude and were abandoned. In recent years, however, they have become revived under a new guise. It is now generally held that at least negative electricity is a material entity, whose particles are all of the same size; so that any quantity of electricity must be a definite multiple of the electronic charge, which is equivalent to assuming that no separate electric quantity less than the electronic charge can exist.

In a somewhat similar way, heat was at one time associated with a certain imponderable fluid named caloric, or occasionally phlogiston, which was emitted by a cooling body. The discovery of the law of conservation of energy led to the abandonment of this conception. Nevertheless, a certain abstract quantity named entropy was created by thermists, such that when multiplied by the absolute temperature the product was a quantity of energy. This entropy corresponded in several ways to quantity, or coulombs, in the electric case, while temperature corresponded to voltage. This entropy is sought to be regarded as caloric in the president's address and is endowed with attributes of a fluid entity. Whereas such entropy or caloric is accepted to be constant in any given quantity of a working substance operating thermodynamically in purely reversible cycles, it is known to increase in amount when the working substance does not operate in such a cycle. For example, when heat is passing from a hot body to a cold body, through a separating layer, by pure conduction, the entropy and caloric in the system are increasing, which would correspond in the electric case to an increase in the coulombs of an electric circuit. The address suggests hypotheses by which this difficulty of the increase of caloric in dissipative heating systems can be met without sacrificing the advantage of substituting a simple fluid concept for the arbitrary abstract notion at present attached to entropy.

A joint meeting of Sections A and G was held to consider some of the problems presented by radio-telegraphy, particularly as to the nature of the electromagnetic waves, as to the effects of sunlight upon their transmission and as to the phenomena involved in directive telegraphy. The discussion was opened by a paper on the subject from Prof. J. A. Fleming. It was participated in by a number of physicists, mathematicians and electrical engineers. The discussion indicated that the phenomena were regarded very differently by these different types of observers, and that in many cases the engineer's view opened from the

PRESIDENT-ELECT SIR WILLIAM H. WHITE.

point where the mathematician's closed, the particular difficulties perceived being of a different character. It was, however, manifest that it is still too early to pronounce definitely on the solutions of many of these problems, but that there is urgent need of the accumulation of more experimental evidence before conjecture can give place to conclusion. It was, therefore, voted to appoint a special committee of the association to take up the research into and discussion of the general problems.

The presidential address in Section G, by Prof. Archibald Barr, was an eloquent plea for efficiency in engineering plants, machinery and devices, not merely on economic grounds, but also for esthetic, artistic and humanitarian reasons. A remarkable proposition was adduced in reference to the injuries and inconveniences that result to the community as incidents of engineering work, namely, that "the more completely the engineer achieves the primary end of his work the less is the damage or injury that can be laid to his charge." As an instance of this general rule, it is manifest that the nuisance of smoke from the chimneys of boiler plants is due to imperfect combustion, or inefficiency in the process of combustion; so that the higher the efficiency of the boiler furnaces the less the chance for the incidental production of soot and smoke.

Of the twenty-four papers presented to the engineering section, two were on magnetic hysteresis, two on electric arcs, one on telephones, and one on the electrical measurement of wind velocities.

A convenient plan adopted by the association is to print in separate booklets short résumés of all the papers presented to each section. These section booklets are very useful and can be secured by application, through the proper official channels.

The annual presidential address of the association as a whole was not directly electrical in its subject matter, being on the nature and origin of life, but it was given by Professor Schäfer, who developed the method of artificial respiration recently advocated by the American Commission on Resuscitation from Electric Shock. The address was of great general interest and has aroused widespread com-

ment. In brief, it takes the position that life is a product of evolution in matter, and that the passage by evolution of non-living to living matter may have occurred on our planet not once only but possibly at many different times. At the same time, the differentiation of living from non-living matter becomes constantly more difficult as our knowledge of the properties of both is extended.

The evening discourse by Prof. W. H. Bragg, on "Radiations Old and New," was noteworthy for its lantern slides, showing the ionization produced in air by radio-activity. That is, the trajectories of individual alpha and beta rays were actually rendered visible to the eye, photographically, by the beautiful experimental process of Professor Wilson. In this process the paths of the rays in air, although primarily invisible to the eye, are marked by numerous electrons, due to collision by impact along the trajectory. These electrons persist for a little while and may become the nuclei of little drops of water vapor, if the air is at the point of aqueous condensation. By suddenly chilling the air at the proper moment the individual trajectories are rendered visible as thin radiating lines of fog where the condensation has occurred selectively. The photographs reveal these fog lines, and their detailed appearances permit of many interesting deductions.

The president of the association for next year will be Sir William Henry White, K.C.B., F.R.S., past-president of the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institute of Metals, the Institute of Marine Engineers and the Institute of Junior Engineers.

I. E. S. CONVENTION PAPERS.

In last week's issue was given an account of the Niagara Falls convention of the Illuminating Engineering Society, Sept. 16 to 19, with the exception of Thursday's proceedings. The convention was notably successful from several aspects, and, considering that it was held far from any city where the society has a section, the attendance was large. There were 158 registered, of whom 107 were members of the society, 29 men guests (mainly prospective members) and 22 ladies.

Before the convention adjourned resolutions were passed thanking those who had contributed time and money to make the convention a success. A special resolution of thanks was ordered prepared for Mr. Norman Macbeth, chairman of the general convention committee, who contributed a large amount of valuable time and personal attention to the preparations for and carrying out of a very successful convention.

REPORT OF THE COMMITTEE ON PROGRESS.

While there is nothing startling to record in the progress made during the past year in the science and art of illumination, it is gratifying to note that more attention than ever before has been paid to the proper installation of lamps, and the public is awakening to a fuller realization of the necessity of scientific methods in illumination. The most conspicuous advance in the material of gas lighting has been the extensive introduction of the artificial silk mantle, which has shown itself capable of longer life and of more uniform efficiency than anything yet tried. The use of high-pressure lighting has increased materially abroad, but as yet few and small permanent installations have been made in this country. The general efficiency of the mantle burner in commercial use has been improved to some extent, and the manufacturers have met the demand for a wider range of burner sizes.

The most important change in incandescent lighting has been the widespread adoption of the drawn-wire tungsten filament. Satisfactory tungsten lamps for 110-volt operation, with ratings as low as 10 watts, have been produced. The larger tungsten lamps up to 500 watts have awakened considerable demand in competition with both gas and electric-arc lamps. Tungsten lamps with ratings as large as 1000 watts are coming into commercial use abroad. A specific consumption of about 0.9 watt per cp is frequently noted in foreign lamps, and at this figure a commercial life of 500 hours or more has been repeatedly claimed.

The chief advance in arc lamps in this country has been toward the production of long-burning flame lamps, which have been adopted on a considerable scale in Chicago and elsewhere. An electrode life of 100 hours or more has been produced by certain manufacturers. The tendency is to use electrodes mineralized practically throughout. A three-phase triple-electrode flame-arc lamp, furnishing a very powerful light of remarkably low specific consumption, has been introduced abroad. In this country the principal novelty is the so-called "boulevard" type of magnetite arc lamp, now used in a number of cities with excellent results. Intensified carbon arc lamps have been coming into steadily increasing use, which is merited on account of their regularity and the desirable quality of their light for color discrimination.

The production of artificial light capable of replacing daylight for color-matching purposes is receiving increased attention. None of the devices yet brought out meets all of the requirements of color discrimination satisfactorily. Among the new illuminants the neon vacuum tube lamp, developed in France, is of much theoretical interest. The quartz mercury arc lamps have also made much progress during the year. Important research work continues to be carried on with aggressiveness. In lighting installations the most noticeable change has been in the direction of indirect and semi-indirect lighting.

Discussion.

Mr. D. McFarlan Moore, commenting on the reference of the report to the neon tube lamp filled with rare neon gas, said that the Moore lighting interests in this country have been taken over by the General Electric Company and that he is now at work developing the neon tube lamp for that company. By means of tube lighting it may be possible, he thinks, to produce light at about one-fiftieth the cost of that obtained from tungsten lamps at the present time.

Dr. C. H. Sharp told of neon tube lamps he had seen abroad operating on 2200 volts from a special transformer at the lamp terminals. The fall of potential at the lamp terminals is large relative to the fall of potential through the remainder of the tube. Therefore it is important to make the tube as long as possible to get high efficiency so as to have the loss at the terminals a low percentage of the whole. The tubes are 4 in. or 5 in. in diameter. They are shipped ready for use instead of being put up in place like the former Moore tubes in this country. The air is exhausted from the tubes by a process using liquid air and charcoal, and they are then washed out with neon. They are said to be giving 1000 hours' life with 0.5 watt per candle consumption. In color the light is a very red orange without blue rays.

Dr. Herbert E. Ives thought the selenium cell hopeless as a means of solving difficulties of photometry. He also thought the photo-electric cell for measuring light energy should be mentioned among important developments made during the year.

In reference to the high efficiency given in the report for tungsten lamps abroad, a member called attention to the fact that American tungsten lamps of 400 watts and 500 watts have recently been improved to a consumption of 1 watt per horizontal candle.

Mr. G. H. Stickney, speaking along the same lines, said that the lamp efficiencies and life adopted as most desirable by American manufacturers were selected as representing the desires and best interests of users and central stations. Higher efficiency means shorter life.

REPORT OF THE COMMITTEE ON NOMENCLATURE AND STANDARDS.

The committee on nomenclature and standards, of which Dr. A. E. Kennelly is chairman and Dr. C. H. Sharp secretary, submitted a report covering international relations and a list of definitions tentatively adopted. The president of the International Photometric Commission, which is at present an organization of the gas-lighting interests alone, has made a formal proposal to the constituent societies to enlarge this commission in such a way as to render it representative of all important photometric interests in a manner satisfactory to them, so that there would be only one single international body charged with the establishment of photometric nomenclature and standards and with the solution of all questions concerning photometry. The proper international action desired by the committee on nomenclature and standards of the Illuminating Engineering Society will eventually be taken up by the international body. In the meanwhile this committee has formulated its views on some important terms and definitions. The definitions proposed relate to luminous flux, stimulus coefficient, luminous intensity, illumination, candle-power, lumen, lux, brightness, coefficients of specular and diffuse reflection, fundamental, primary, secondary, reference and working standards, comparison and test lamps, and performance and characteristic curves.

THE DETERIORATION OF GAS-LIGHTING UNITS IN SERVICE.

Tests relating to the deterioration of gas-lighting units in service were outlined in a paper by Mr. R. F. Pierce. Tests were made on twelve inverted gas-mantle burners selected at random from factory stock, which were equipped with artificial fiber mantles similarly selected. At the end of a period of from 4000 to 5000 hours the specific consumption had increased by an average of 8.5 per cent. The deterioration in candle-power fell from 2.14 per cent per 5000-hour period to 5.34 per cent per 2000-hour period. The author claimed that, so far as the design of illumination is concerned, there is no substantial difference between the performance of gas and electric units, and the quantity of illumination required and initially obtained by the one will be equally suitable for the other. A short discussion was participated in by Messrs. C. O. Bond, of Philadelphia, and Ward Harrison, of Cleveland, Ohio.

SYMPOSIUM ON HIGH-PRESSURE GAS LIGHTING.

A three-part symposium on high-pressure gas lighting was presented by Messrs. F. W. Goodenough, Oscar Klatte and R. N. Zeek. Part 1, by Mr. Goodenough, dealt with high-pressure gas lighting in Great Britain. Part 2, by Mr. Klatte, discussed conditions in Germany, showing that its use has been increasing rapidly in the last few years. Mr. Zeek, who contributed Part 3 of the symposium, described some of the features of high-pressure gas lighting in America. He referred briefly to installations in Philadelphia, Waterbury, Conn.; Wilmington, Del.; Washington, Des Moines and Chicago.

TESTS ON CAR LIGHTING AT WASHINGTON, D. C.

Mr. Arthur J. Sweet, commercial engineer of the Nelite Works of the General Electric Company, was requested to give some account of the tests which he is conducting on steam railroad car lighting at Washington, D. C. Some of the points brought out by his informal address were as follows:

These tests are being conducted under the auspices of the Baltimore & Ohio Railroad and the expense is being borne by various reflector and car-fixture manufacturers jointly with the railroad company. Tests will be made on all of the common types of cars used in steam-railroad service and on various lighting equipments. At the present time tests are nearly completed on railway postal cars and in these tests the United States postal authorities have taken an active interest, as the results should be of great value in determining the best type of postal car lighting for the proposed standard postal car specifications. These tests have included equipments of gas and electric units distributed over the car and provided with various types of reflectors. The tests have been witnessed at various times by fourteen division superintendents of the United States railway mail service and by nearly all railway electrical engineers. A 60-ft. postal car was set aside for the work. Measurements have been made of horizontal illumination and also of the vertical illumination on the face of the letter boxes. Some study has also been made of shadows. An attempt was also made to learn which kind of installation was the most comfortable to read under. About 400 observations were taken with different lighting systems and with ten different subjects, five of whom were postal service men. The illumination was raised from almost darkness up to the point considered the minimum for continuous comfortable work by the subjects, which point was noted, and then it was raised again, to a point considered ample. The method was similar to that adopted by Mr. J. R. Cravath in the paper reported at the 1911 convention. Mr. Sweet's results in general confirmed the conclusions of the paper referred to. The systems which gave the most diffused light on the reading page required the least illumination for comfortable reading. The lowest values were obtained with indirect lighting with Pintsch gas. There was some question as to the possibility of keeping car ceilings light enough in service to make this system feasible. Of the direct-lighting systems the one using a large number of small lamps in aluminum finished reflectors gave the best results in illumination required. Translucent glass reflectors and mirrored reflectors required more illumination, presumably on account of their reflecting surface being less diffusing and causing slightly more glare on the reading page. The paper used in the test was not a glossy paper. This brought out the point that the glare of specular reflection from paper may be a very disturbing influence in comfortable reading even though the paper is one from which there is no noticeable glare. In these tests the highest average illumination required by any subject was 4.5 ft.-candles, and the average illumination considered ample by all the subjects was 3.5 ft.-candles.

THE METHODS OF RESEARCH.

In a brief paper on this topic Dr. Edward P. Hyde analyzed from a critical standpoint some of the research methods which have been employed in scientific investigations. Truth, he said, is always the goal of research, and all truths may be distinguished in two classes: first, those which are known directly or of themselves, as our own bodily sensations, and, second, those truths which are known through the medium of other truths, as the theorems of mathematics. The former are the subject of intuition or consciousness, the latter of inference. Practically all of the truths of physical science are found through inference. In arriving at truth through inference logicians distinguish two methods, that of induction and that of deduction. By the first is meant the process of drawing a general conclusion from particular cases. In the second method there are two processes, observation and experiment. The deductive method of investigation consists of three steps: First, direct induction; second, ratiocination, or reasoning; and third, verification. It is evident that these two methods of arriving at truth by inference are not independent. The basis of the deductive method is a previous induction, and the two methods are interdependent. The inductive method in research consists of observation and experiment, and the author designated two subordinate methods of induction termed definitive and non-definitive. The deductive method of research is one of hypothesis or theory, ratiocination and verification. It is peculiarly the method of mathematical sciences. Granted a definite scheme

of research (the definitive inductive method), or a desired conclusion (the deductive method), it is quite possible to lay down a general formula which will be of assistance in carrying out the experimental work. Such a general plan includes: (1) Exact definition and statement of problem; (2) study of literature pertinent to the problem; (3) determination of experimental method; (4) choice or design of apparatus; (5) isolation of specific phenomenon to be studied, or of quantity to be measured, and elimination of complicating phenomena or quantities; (6) preliminary investigation of instruments used; (7) investigation and discussion of sources of error; (8) careful analysis of results; (9) justifiable conclusions.

In conclusion the author referred to the extensive harm down by incompetent investigators, who infer generalizations from inadequate data or draw conclusions from non-established inductions.

HETEROCHROMATIC PHOTOMETRY AND PRIMARY STANDARD OF LIGHT.

In a paper on this subject the author stated that the two problems of major importance in the science of light measurement are: First, the problem of the photometry of lights of different colors; and, second, the problem of securing a scientific primary standard of light. Four photometric methods were considered, namely, visual acuity, critical frequency, equality of brightness and flicker. As a result of these investigations the author recommended that the following requirements be standardized in heterochromatic photometry: (1) The use of the flicker photometer; (2) an illumination of 25 meter-candles (understood to be on a white surface, such as magnesium oxide); (3) a photometric field of 2 deg. diameter, surrounded by an approximately equally bright area of 25 deg. diameter (the small field is chosen because with it the effect of varying the illumination is largely eliminated; the bright surrounding field is introduced because it has been found to increase the comfort and sensibility of reading, without the disadvantage of the large photometric field); (4) the observer must have an average eye.

The author discussed the question of a primary standard of light from the standpoint of radiant energy, and pointed out that the sensation of light is caused by radiant energy of a certain quality, measurable in the fundamental units of length, mass and time. Assuming a flux of radiant energy of value E measured in watts, its value as light flux may be found by introducing the specific luminous output of the radiation K expressed in lumens per watt, or flux of light $= K E$. Expressing K as the product of the luminous efficiency of the source and the maximum possible specific luminous output, or $K = \mu K_{max}$, it follows that luminous flux $= \mu K_{max} E$. If K is made unity and E is expressed in watts, then the unit of luminous flux will be the flux from a source radiating energy of maximum luminous efficiency at the rate of 1 watt.

In conclusion the author laid before the society two proposals: First, that the conditions of heterochromatic photometry outlined above be adopted as standard; and, second, that the unit of luminous flux be specified in terms of flux of radiation and luminous efficiency, as outlined above.

NEW METHOD AND INSTRUMENT FOR DETERMINING REFLECTING POWER OF OPAQUE BODIES.

In a paper by Dr. P. G. Nutting were described a new method and an instrument for determining the reflecting power of opaque bodies. The method is based on the use of two parallel planes, one of which is a diffuse illuminator and the other is a surface the reflecting power of which is to be determined. The relative brightness of the two planes represents the reflecting power of the non-luminous plane. A description is given of a simple device for determining the relative illumination on the two planes. Use is made of a brass ring heavily nickel-plated and polished. Into this ring is inserted a polarization photometer, used to determine the relative brightnesses of the two planes at the center of the ring.

DETERMINATION OF ILLUMINATION EFFICIENCY.

Mr. E. L. Elliott presented a paper in which was described a proposed method of determining illumination efficiency. The method is one intended to give proper weight to the light received from all directions above the horizontal plane. In carrying out the method use is made of apparatus similar in many respects to that employed with the so-called globe photometer. The beams of light from all angles above the horizontal are allowed to pass through an opening in the horizontal plane surface, and the average intensity over the opening is determined in screens with the well-known principle of the globe photometer. A brief adverse discussion upon the proposed method was participated in by Messrs. M. Luckiesh, A. J. Sweet and Preston S. Millar.

DIFFUSE REFLECTION AND TRANSMISSION OF LIGHT.

In a paper on the "Diffuse Reflection and Transmission of Light," Dr. P. G. Nutting distinguished three different types of diffusing screen. The three types of diffusion are: (1) Transmission with maximum diffusion and minimum absorption. Such screens are required to reduce the intrinsic brilliancy of sources with the minimum loss of light. (2) Diffuse reflection with both reflecting power and diffusion a maximum. Such properties in wall coverings not only save light, but produce a more uniform illumination with fewer fixtures. (3) Diffuse reflection with high reflecting power, but with the reflected light massed within a given angle. Reflection of this type produces light economy in indirect illumination as well as in projection screens.

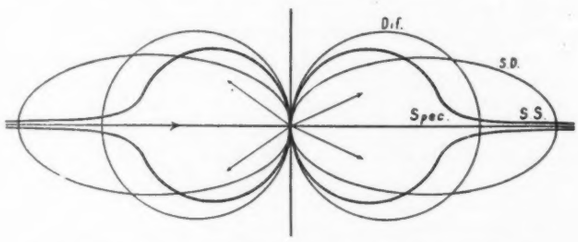


Fig. 1—Varieties of Diffuse Reflection and Transmission.

In a laboratory survey of these problems one finds examples of practically all kinds of diffuse reflection and transmission, as indicated in Fig. 1. These include the purely specular, semi-specular, the selectively diffuse and the perfectly diffuse distributions of both reflected and transmitted light. Practically any amount of absorption may occur with any type of diffusion. Each case of diffusion may be traced to particular kinds of reflection, refraction and diffraction within or near the surfaces of bodies. Different types of selective diffusion are shown in Fig. 2. Assuming

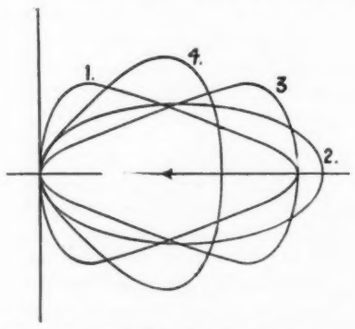


Fig. 2—Types of Selective Diffusion.

that the reflecting surface is composed of a layer of minute reflecting spheres of uniform size, the author showed mathematically that such surfaces would reflect in accordance with Lambert's law, except as the specular reflecting power of each sphere varied with the angle of incidence; the coefficient of diffuse reflection would be $\frac{\pi R}{8}$ neglecting multiple reflection from sphere to sphere. Next the author considered the case of a mass of minute plain reflecting surfaces spread loosely in an approximate plane, and also the case of surfaces composed of small transparent particles, such as snow and other crystals, and in each instance theory indicated that reflection following Lambert's law is to be expected.

A PROPOSED METHOD OF DETERMINING A COEFFICIENT OF DIFFUSION FOR TRANSLUCENT MEDIA.

The author of this paper, Mr. E. L. Elliott, defined the coefficient of diffusing power of a globe as the ratio of its maximum to its minimum brightness. He proposed that in determining this ratio use be made of one of two methods. First, a screen having a small opening may be moved about in front of the globe and the intensity of illumination of the visible space determined by means of a photometer. Second, the globe could be projected on a white screen and the intensity on the various parts of the screen measured by an illuminometer arranged for determining surface brightness. The ratio thus determined, together with the absorption factor, would give complete and definite information as to the value of the diffusing globe.

Discussion.

Dr. C. H. Sharp thought Mr. Elliott's proposal along correct lines and Mr. C. O. Bond reported having used practically this method in connection with the testing of gas globes. Mr. H. P. Gage, of the Corning Glass Works, said that from the standpoint of a glassmaker he would like to see some such method of rating established.

SOME REFLECTING PROPERTIES OF PAINTED INTERIOR WALLS.

Reflection coefficients for various types of wall papers are often of great assistance to the illuminating engineer in working out specific lighting problems, and Mr. Claude W. Jordan presented a paper describing some of the results recently obtained in determining such coefficients for painted interior walls. A knowledge of the coefficients of painted walls is becoming more important, because it has been proved that in comparison with papered walls, from a sanitary standpoint, painted walls are decidedly superior. The author's results were presented in both graphic and tabular form, covering various types of both flat and glossy finish paints.

REPORT OF THE ILLUMINATION COMMITTEE OF THE ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS.

The illumination committee of the Association of Iron and Steel Electrical Engineers, of which Mr.C. J. Mundo is chairman, described the work undertaken since 1910, when the association first became interested in the subject of illumination. The present committee was appointed at the 1911 convention of the association to study and report on the needs of the iron and steel works engineer with respect to illumination. Attention was called to the fact that next to the mean lower hemispherical candle-power of the illuminant the most important question is that relating to the deterioration of the candle-power in service. The committee made the following recommendations: (1) That in judging lamp size the mean lower hemispherical candle-power or the downward lumens be used, in conjunction at least with the average inherent deterioration of the lamp during the life or trim. The liability of the lamp to deteriorate can be judged on the basis of mechanical construction until acquired deterioration data are available. (2) That the illumination curve for the height at which the lamp must be used be employed to check the evenness of the illumination from the lamp and the utilization of the light. (3) That manufacturers be encouraged to submit candle-power distribution, illumination and deterioration curves on illuminants. (4) That manufacturers be urged to submit constant or spacing tables for the use of lamps. (5) That illumination tests be encouraged by the members for the purpose of obtaining data on deterioration. (6) That the association co-operate with the Illuminating Engineering Society by encouraging such tests and by presenting from time to time for discussion and solution the problems of the members.

PRESENT PRACTICE IN SMALL STORE LIGHTING WITH TUNGSTEN-FILAMENT LAMPS.

Messrs. Clarence L. Law and A. L. Powell presented an extended paper describing present practice in small store lighting with tungsten-filament lamps, the purpose of which was not to advance new ideas on lighting but rather to submit a record of current practice in this particular field. In other words, the paper can perhaps be characterized as an attempt to determine the present state of this branch of the art, and it is therefore mainly descriptive. Illustrations were presented showing the interior lighting arrangements of twenty stores of the smaller retail class in various lines of business.

Discussion.

Mr. Ely, of Philadelphia, spoke in favor of individual treatment of each case in order to have some variety and avoid monotony of design rather than treat store lighting by the wholesale as suggested by the paper. Mr. A. H. Keleher thought that certain general averages could be established, and in fact would have to be established, for planning large numbers of small store installations. One watt per square foot was his estimate. He also spoke in favor of better and more artistic fixtures, such as are used in foreign countries. Mr. H. C. Sterling, central station manager from Three Rivers, Mich., said that men of his class wanted more of this kind of papers. Many of the papers presented in the society were above their heads, but this paper gave information which could be put into practical use, and if the society would have more of them they would attract more of the smaller central-station managers. He said that in small towns what the people think they want is glare—the more the better. He though the first men to receive the "Illumination Primer" should be the central-station managers. Mr. J. R. Cravath said that as a manager of several central stations in smaller towns he had found it true that what many people were looking for is glare. However, after some installations representing the best modern practice were made, the more progressive customers soon wanted the same thing. Mr. Flexner, of the Commonwealth Edison Company, Chicago, said that it was the prcatice of his company to treat each installation by itself. Mr. C. O. Bond, of Philadelphia, objected to having clothing stores rated for higher intensity illumination than grocery stores. Mr. H. T. Owens, of New York, thought it well to consider in installing wiring that many of the lighting installations of the future will employ indirect lighting.

CHARACTERISTICS AND TESTS OF CARBONS FOR INCLOSED FLAME-ARC LAMPS.

A paper by Messrs. Allen T. Baldwin and Richard B. Chillas, Jr., dealt with the characteristics and tests of electrodes for inclosed flame-arc lamps. An outline was given of the operating features of the usual types of flame-arc lamp electrodes, special attention being devoted to the difficulties encountered by reason of the fumes. Next a synopsis was presented of tests such as lamp owners can readily make, in order to obtain a measure of the extent to which the respective characteristics exist in the electrodes and to determine their value for the service desired. The tests described would require the use of ammeters, voltmeters, an

integrating sphere and a photometer of the Sharp-Millar type. The authors claimed that the problem of devising adequate measures of color, particularly that of fluctuating light sources such as the flame-arc lamp, has not been satisfactorily solved. They recommend merely that all conditions surrounding comparative color and value tests be as nearly identical as possible.

Discussion.

Mr. R. B. Hussey, of Lynn, said there are now 5000 inclosed flame-arc lamps in street lighting service in this country. Mr. S. L. Rose, of Schenectady, noted that in laboratory trials such flame lamps slag worse when turned on and off a few times before starting than after they have been run a few hours. He inquired the probable reason. Mr. Spaulding, of Cleveland, noted variations in candle-power from 500 to 3600 within thirty minutes in tests made on certain lamps, a fluctuation which considerably detracted from their value as illuminants.

Mr. Baldwin, in answering the question of Mr. Rose, said that at the present time such carbons are made with the impregnation extending the full length and they are cut off in a machine to standard lengths after being manufactured. The carbon acts like a wick when heated in operation, and consequently there is an excess of flame material at the tip of the carbon when the lamp starts. When these carbons are made in large quantities with a smaller amount of flame material at the end, this condition may be changed. He recommended making tests and regulating lamps after at least three-quarters of an hour of operation.

THEORY AND CALCULATION OF ILLUMINATION CURVES.

In a paper entiled "Theory and Calculation of Illumination Curves," Mr. Frank A. Benford, Jr., described an elaborate method of determining the density of luminous flux over any plane area when the space distribution of the candle-power around the lighting source is known. Use is made of a drafting board, a T-square and a "triangle," together with a previously calculated chart and a tabulation of the relations between heights of suspension, distances from source, candle-powers and foot-candles.

LIGHTING OF BUFFALO GENERAL ELECTRIC COMPANY'S BUILDING.

Mr. W. D'A. Ryan presented a paper describing the lighting equipment of the Buffalo General Electric Company's office building, the lighting specifications of which were drawn by the illuminating engineering department of the General Electric Company. The general interior illumination is semi-indirect, the fixtures having been especially designed for the building. The number of watts per square foot for the entire building averages 1.4. The illumination is not less than 4 and not over 6 ft.-candles, except in a few special cases, such as in the drafting room, where it is slightly higher. The main units in the offices throughout are of the semi-indirect convertible type, making it possible for the respective tenants to have either direct or semi-indirect lighting as they may desire. Along the sidewalk line, mounted on standards, are 6.6-amp series ornamental luminous-arc lamps giving a white light. The effect at night is of a white building, relieved by the warm yellow light of the tungsten lamps streaming through the windows, rising to a colonnade illuminated by concealed blue-purplish light in simulation of shadow effect, contrasted with the white light thrown on the outer surface of the columns by the luminous-arc lamps. Mounted on a revolving platform in the dome are three 30-in. projectors provided with motors, so that they revolve on their own centers through color evolutions produced by screens on the projectors.

Abstracts of papers entitled "Tests for Efficiency of the Eye Under Different Systems of Illumination," "The Engineering Principles of Indirect and Semi-Indirect Lighting," "Vision as Influenced by Brightness of Surroundings" and "A Study of Natural and Artificial Light Distribution in Interiors" will appear in a subsequent issue.

NORTHWEST ELECTRICAL CONVENTION.

The fifth annual convention of the Northwest Electric Light and Power Association was held in Portland, Ore., on Sept. 11, 12, 13 and 14, the meeting being the most successful that the association has ever held. In addition to the formal papers and discussions there were many entertainment features, including a "rejuvenation" of the Sons of Jove, the annual banquet and a trolley ride to an old-fashioned picnic at Estacada, which is situated near the Portland Railway, Light & Power Company's hydroelectric plants on the Clackamas River.

The convention was called to order on Wednesday, Sept. 11, in the Multnomah Hotel in Portland by President J. E. Davidson. There were about 125 delegates from Oregon, Washington, Idaho and British Columbia in attendance on the first day, and before the convention was over nearly 200 delegates had registered. An important feature of the convention was the interest displayed by members of the Public Service Commission of Washington and the Railroad Commissioner of Oregon. The latter will soon have control over public utility companies in Oregon if the law which is now before the people of the State is carried.

Mr. Edgar B. Piper, president of the Portland Commercial Club, in welcoming the delegates to Portland, related many interesting events in the development of electrical undertakings in the West.

PRESIDENT'S ADDRESS.

In his presidential address Mr. Davidson called attention to the fact that the Northwest association secured during the year ten new company members, making a total of fifty. He urged upon the member companies the desirability of forming company sections and brought out the financial phase of increased membership. He spoke with pride of the excellent action taken by the Northwest association in becoming affiliated with the National Electric Light Association and thereby securing a number of advantages that it had not previously possessed. He also called to mind the Seattle convention and the opportunity it gave to Northwest association members to see how big and strong the National Electric Light Association really is. The Northwest association will endeavor to carry out a campaign of education relative to resuscitation and will also co-operate with the public service commissions in its territory. Mr. Davidson closed his remarks with a strong appeal for co-operation with the public.

PROFITABLENESS OF RESIDENCE LIGHTING.

The first paper before the convention was one by Mr. O. B. Snyder, of Seattle, entitled "Is Residence Lighting Profitable?" The author called the attention of central stations to a very profitable field for investigation and requested the delegates present to urge upon their companies the desirability of investigating a number of problems relative to residence lighting and conditions attendant thereon.

RATES.

In a paper by Mr. D. C. Barnes on "Justification of a Rate" were discussed the various methods of rate making, together with the conditions and factors that enter therein. The author paid particular attention to the distinctive features that mark some of the important methods of estimating bills. Mr. Barnes' conclusions were that the rates charged by the companies in this association are not in excess of what the service is reasonably worth, although he thought there should be a careful analysis made to determine whether the rates charged for different classes of service yield a reasonable return upon the fair valuation of the property employed. The paper contained many statistics relative to rates used in various cities throughout the Northwest.

UNIFORM ACCOUNTS.

Mr. F. Shaw Baker, of Butte, Mont., presented a paper

on "Uniform Classification of Accounts for Electric Light and Power Companies" in which was urged the necessity of correct accounting methods and complete statistics, for by their use only can a company properly estimate the value of its business and the service rendered. Mr. Baker then discussed the results that had been obtained by the Butte Electric & Power Company with the uniform system of accounting recommended by the National Electric Light Association and the New York Public Service Commission.

INTANGIBLE VALUES OF PUBLIC UTILITIES.

Mr. William J. Hagenah, formerly chief statistician of the Wisconsin Public Service Commission, read a paper on "Intangible Values of Electric Lighting and Power Properties."

He treated the development of the movement for regulation of public utilities, discussing the leading decisions of state and federal courts and public service commissions. The various forms in which regulation is exercised were explained, together with the principles which underlie the determination of the facts which govern in each case. The speaker outlined the evils of competition in the public utility industries, which, he concluded, not only cause a great increase in the fixed charges through the duplication of investment but greatly interfere with sound regulation by public utility authorities on the comprehensive scale which is necessary in order to make it most successful. Mr. Hagenah claimed that public utilities should receive credit for the costs incurred in developing their business, and in this determination the reasonable and necessary discounts on early construction bonds and the losses due to enforced competition should receive proper weight by rate-regulating bodies.

Mr. Clyde B. Aitchison, a member of the Railroad Commission of Oregon, said that the problems which Mr. Hagenah suggested are economic in nature and in no sense judicial or political and that they must be solved by the meeting of mind and mind and the clashing of argument against argument. Mr. Aitchison congratulated the electric utilities on their efforts to secure uniform accounting features and said that the electrical industry is in advance of steam railroads in this feature of administration.

Mr. G. A. Lee, of the Public Service Commission of Washington, stated that the public service act of Washington uses the expression "market value," and that this may have a tendency to complicate the question of intangible values. He also stated that it is a well-known fact that the expression "market value" implies a sale between a willing seller and a willing buyer, but that frequently there may not be a "market value," although there may be a "sale value" and in some cases there is a "condemnation value." He also pointed out that the valuation that the Public Service Commission of Washington might render for rate-making purposes must be certified to the Tax Commission and State Board of Equalization, and that anything less than this valuation cannot be taken for assessment and taxation purposes. He gave an example of a case recently filed against a large company in Washington in which the commission found that the rates were so low as not to warrant a fair return on the investment and the complaint was therefore dismissed. These problems, he said, are constantly coming before the board and require a great deal of attention. Mr. Lee also stated that every progressive utility manager should interest himself in proposed legislation.

The convention was addressed by Mr. F. T. Griffith, a member of the Portland bar, who spoke on "Public Service Commissions."

COMMERCIAL DEPARTMENT.

In a paper on "Relative Value of the Commercial Department in Central-Station Service," Mr. A. F. Douglass, of Portland, stated that by proper development of the commercial department a closer relationship is obtained between the central stations and the public, with the result that the commercial departments more than justify their existence. Mr. Douglass told of a number of instances where various departments of the public service companies had become acquainted with many surprising facts regarding their own organization simply from statistics and figures provided in the commercial department.

ELECTRICITY IN IRRIGATION WORK.

The last paper before the convention was one by Mr. George C. Arrowsmith, of North Yakima, Wash., upon the "Use of Electric Power for Irrigation and Other Rural Purposes." In the semi-arid territory of the Yakima,

PRESIDENT-ELECT WILLIAM J. GRAMBS.

Columbia and Walla Walla valleys lands which without water are worth nothing have been made productive by water obtained either through gravity flow or irrigation pumping until they bring in from $50 to $500 per acre per year, according to the crop grown and the degree of cultivation. Mr. Arrowsmith discussed the farmer as a patron of electric companies and outlined the problem of electric pumping. He told of the various methods of irrigation and pumping from deep driven wells, artesian wells, shallow dug wells, rivers and canals.

ELECTION OF OFFICERS.

The annual election of officers resulted in the selection of the following gentlemen: President, Mr. W. B. Grambs, Seattle, Wash.; vice-president for Idaho, Mr. J. J. Jennings; vice-president for Oregon, Mr. A. C. McMicken, Portland, Ore.; members executive committee for three-year term, Messrs. O. B. Coldwell, Portland, Ore., and Douglass Allmond, Anacortes, Wash.; member executive committee for one-year term, Mr. Elmer Dover, Tacoma, Wash.; secretary-treasurer, Mr. N. W. Brockett, Seattle, Wash.

Mr. William J. Grambs, the newly elected president of the Northwest Electric Light & Power Association, was born in Honesdale, Pa., and educated at the United States Naval Academy at Annapolis. In the spring of 1888 he engaged in the electrical business in Seattle, Wash., and established the Northwest Electric Supply & Construction Company, which acted as agent for many of the large electrical manufacturing companies of the Middle West and East. In 1899 Mr. Grambs was appointed purchasing agent of the Seattle Electric Company, of which he became contract agent in 1905 and sales manager in 1907. In November, 1911, he was promoted to be superintendent of light and power of the company, and when the latter was absorbed by the Puget Sound Traction, Light & Power Company, early this year, Mr. Grambs was appointed superintendent of light and power of the Seattle division.

REGULATIONS OF THE LONDON WIRELESS CONFERENCE.

The holding of the International Wireless Conference at London, which terminated on July 5, being still freshly in mind, our readers will recall that an impenetrable veil of secrecy was cast over the proceedings and nothing more than a meager statement was made public in London at the close of the proceedings or since. A summary of that statement, accompanied by editorial comment on the situation, appeared in our issue of July 27. On Aug. 9 the House of Representatives passed the Bourne bill to regulate wireless communication, more than a month after the London convention was officially signed. President Taft on Aug. 16 approved this bill, as noted in our issue of Aug. 24. Nevertheless, no authentic details of the London proceedings have been made public up to this time. However, we are now able to present our readers with a full transcript of the London convention and the final protocol, and an abstract of the Regulations, which follow in order:

CONVENTION.

"The undersigned, plenipotentiaries of the governments of the countries enumerated above, having assembled in conference in London, have with common accord, and with the limitations of ratification, determined upon the following agreement:

"Article I. The contracting parties promise to apply the resolutions of the present convention in all radio-telegraphic stations (coast stations and marine stations) which are established or managed by the contracting parties and open for the service of public intercourse between the land and the ships at sea.

"They also promise to impose the observation of these resolutions upon all private enterprises authorized either to establish or to manage radio-telegraphic coast stations open to the service of public intercourse between the land and vessels at sea, or to establish or manage radio-telegraphic stations, whether open to the service of public intercourse or not, on board vessels carrying their flag.

"Article II. Every radio-telegraphic station established on land or on board a permanently anchored vessel and used for communication with ships at sea is called a coast station. Every radio-telegraphic station established on board a vessel other than a permanently anchored ship is called a ship station.

"Article III. The coast and ship stations are obliged to exchange radio-telegrams without regard to the radio-telegraphic systems used by these stations. Each ship station is obliged to exchange radio-telegrams with every other ship station without regard to the radio-telegraphic system used by these stations.

"However, in order not to hinder scientific progress, the resolutions of this article shall not interfere with the future use of a system of radio-telegraphy incapable of communicating with other systems, provided that this inability be due to the specific nature of the system, and not the result of arrangements adopted solely for the purpose of hindering inter-communication.

"Article IV. Notwithstanding the provisions of Article III, a station may be destined for a restricted public service determined by the purpose of the correspondence, or by other circumstances independent of the system used.

"Article V. Each of the contracting parties promises to join the coast stations to the telegraphic system (network) by special wires, or, at least, to take other measures insuring a rapid exchange between the coast stations and the telegraphic system.

"Article VI. The contracting parties will give each other the names of the coast stations and the ship stations under the scope of Article I, as well as all indications necessary to facilitate and to accelerate the radio-telegraphic exchange which will be specified in the regulations.

"Article VII. Each of the contracting parties reserves the power to prescribe or to admit, except in the stations under the scope of Article I, independent of the installation concerning which information is made public according to Article VI, other purview, which shall be established and managed for the purpose of special radio-telegraphic transmission, whose details need not be made public.

"Article VIII. The management of the radio-telegraphic stations is to be organized so as to give as little disturbance as possible to other stations of the same kind.

"Article IX. The radio-telegraphic stations are obliged to give absolute priority to appeals of distress wherever they may come from, to reply in the same manner to these appeals, and to give them the precedence.

"Article X. The price of a radio-telegram includes, according to the case:

"1. (a) The 'coast price' which belongs to the coast station. (b) The 'ship price' which belongs to the ship station.

"2. The price for the transmission by telegraph, calculated according to the regular custom.

"3. The prices of transmission from coast stations or intermediate marine stations and the prices appertaining to special services asked by the sender.

"The rate of the coast price is subject to the approbation of the government to which the coast station belongs; that of the marine price to the approbation of the government to which the ship belongs.

"Article XI. The resolutions of the present convention are supplemented by a regulation which has the same power and is in force simultaneously with the convention. The prescriptions of the present convention and of the regulation relative thereto may at any time be changed by common consent of the contracting parties. Conferences of plenipotentiaries having power to change the convention and the Regulations will take place periodically; each conference will choose the place and the time for the next reunion.

"Article XII. The conferences are composed of delegates from the contracting countries. In the debates each country has only one vote. If a government represents its colonies, possessions or protectorates at the convention, the interior conferences may decide whether the whole or a part of the colonies, possessions or protectorates shall be considered as forming one country for the application of the preceding sentence. In every event the number of votes at the disposal of any government, including its colonies, possessions and protectorates, shall not exceed six. The following are considered as forming a single country for the application of the present article. [List omitted.]

"Article XIII. The International Bureau of the telegraphic union is charged to gather together and to publish all information relating to radio-telegraphy, to inform the convention of the demands for modifications, to promulgate the charges adopted, and in general to take care of the administrative works attendant upon the interests of international radio-telegraphy. The expenses of this institution shall be met by all the contracting countries.

"Article XIV. Each of the contracting parties reserves the right to fix the conditions under which it will admit radio-telegrams passing through or destined for a station, either coast or ship, which is not submitted to the consideration of the present convention. If a radio-telegram is admitted, the regular prices are applicable to it. The right to pass is given to all radio-telegrams coming from a ship station and received by a coast station of a contracting country or accepted in transit by the government of a contracting country. The right to pass is equally given to all radio-telegrams destined for a ship, if the government of a contracting country has accepted them in transit from a non-contracting country, subject to the right of a coast station to refuse the transmission to a marine station of a non-contracting country.

"ARTICLE XV. The regulations of Articles VIII and IX of this convention are equally applicable to radio-telegraphic installations other than those included in Article I.

"ARTICLE XVI. The governments which have not taken part in this convention have a right to be admitted at their request. This request is made known diplomatically to that one of the contracting governments in which the last conference took place, and by it to all the others. This admission gives full rights of all the clauses of the present convention and to all the advantages herein stipulated. The admission of the government of a country having colonies, possessions or protectorates does not include the admission of the colonies, etc., unless a declaration to this effect has been made by the government. The whole of the colonies or one separate one may be admitted under the conditions of the present article and of Article XXII.

"ARTICLE XVII. The resolutions of Articles I, II, III, IV, V, VI, VII, VIII, XI, XII and XVII of the international telegraphic convention of St. Petersburg of July 10 to 22, 1875, are applicable to international radio-telegraphy.

"ARTICLE XVIII. In case of a disagreement between two or more contracting governments relative to the interpretation or execution either of the present convention or of the Regulations referred to in Article XI, the question may, by common accord, be submitted to arbitration. In this case each of the interested governments chooses another disinterested one. The decision of the arbiters is determined by the majority of the votes. In case of a tie the arbitrators shall choose another disinterested government. In case there is a dispute as to the choice, each government shall propose a disinterested contracting government, and lots shall be drawn between the disinterested governments. The drawing of lots shall take place on the territory of the government on which the International Bureau is working as provided in Article XII.

"ARTICLE XIX. The contracting parties promise to take or to propose to their respective legislatures the necessary measures to assure the execution of the present convention.

"ARTICLE XX. The contracting parties will inform each other as to the laws already passed or which are about to be passed in their countries relating to the object of the present convention.

"ARTICLE XXI. The contracting parties retain their absolute liberty relative to radio-telegraphic installations not included in Article I, and especially naval and military installations, as well as stations insuring communication between fixed points. All these installations and stations are subject only to the obligations mentioned in Articles VIII and IX of the present convention. Always, when these installations and stations exchange public maritime intelligence, they shall conform, so far as the execution of this service goes, to the rules of the Regulations, so far as the method of transmission and the responsibility are concerned. If, however, coast stations guarantee communications between fixed points at the same time that they communicate public correspondence to ships at sea, they are not subject for this service to the Regulations of the convention except so far as Articles VIII and IX are concerned. However, fixed stations which communicate between land and land may not refuse to exchange radio-telegrams with another fixed station because of the system used by the latter; always each country is absolutely free so far as the organization of the service between fixed points is concerned, and the determination of the correspondence done by the stations belongs to this service.

"ARTICLE XXII. The present convention shall be put into execution on July 1, 1913, and shall remain in force for an indefinite length of time and until the expiration of a year from the day of its denunciation. The denunciation has effect only in respect to the government in whose name it is made; for all the other contracting parties the convention remains in force.

"ARTICLE XXIII. The present convention shall be ratified and the ratifications shall be deposited in London as soon as possible. In case one or more of the contracting parties does not ratify the convention, it will be none the less binding on the parties who shall have ratified it. In testimony whereof the respective plenipotentiaries have signed the convention by an exemplary which shall remain among the archives of the British government and a copy of which shall be kept in Paris.

"London, July 5, 1912." [Signatures omitted.]

FINAL PROTOCOL.

"At the moment of proceeding with the signing of the convention agreed upon by the international radio-telegraphic conference of London, the undersigned plenipotentiaries agreed upon what follows:

"I. The exact nature of the acquiescence announced in the interest of Bosnia-Herzegovina not being as yet decided upon, it is recognized that if a voice is attributed to Bosnia-Herzegovina, a decision comes up as to whether this voice belongs to it because of Article XII of the convention, or if this voice is in accord with the third paragraph of this article.

"II. It has made the following declaration: The delegation from the United States declares that its government finds its necessary to abstain from all action concerning the prices, because the transmission of radio-telegrams, as well as of telegrams, in the United States, is managed, either entirely or in part, by commercial or special companies.

"III. It has also made the following declaration: The government of Canada reserves the right to fix separately for each one of its coast stations a total ship price for radio-telegrams originating in North America and destined for a ship, the coast price mounting from three-fifths of the price on board to two-fifths of this total price.

"In witness whereof the respective plenipotentiaries have drawn up the present final protocol, which shall have the same force and the same weight as if these resolutions had been inserted in the text of the convention to which it refers, and they have signed it in an exemplary which shall be deposited among the archives of the British government and a copy of which shall be delivered to each party.

"London, July 5, 1912."

SERVICE REGULATIONS.

I. ORGANIZATION OF RADIO-TELEGRAPHIC STATIONS.

No restriction is placed upon the choice of apparatus to be used by coast or ship stations, and these installations should correspond as far as possible with scientific and technical progress. Two wave-lengths, one of 650 meters and the other of 300 meters, are allowed for general public correspondence, and every coast station open to this service should be so equipped as to operate with these two wave-lengths, one of which is designated as the normal wave-length of the station. During the time it is open, each coast station should be ready to receive calls made at least at its normal wave-length. For the repetition of original messages and documents by ship stations to their respective governments, use is made, however, of a wave-length of 1800 meters. Each government may authorize the use in coast stations of other wave-lengths for the purpose of insuring long-distance service other than that of the general public correspondence, but established in accordance with the rules of the convention and with the reservation that the wave-lengths shall not exceed 600 meters or that they shall be greater than 1600 meters.

Stations used exclusively for sending signals for the purpose of determining the position of ships shall not use wave-lengths of more than 150 meters. All ship stations should be equipped for the use of wave-lengths of 600 meters and of 300 meters. The former is the length of normal waves, and cannot be exceeded except in the case of a sender on shipboard, who has always the right to designate by which coast station he wishes his radio-telegram to

be sent; and in such case the ship station waits until that particular coast station is the nearest one. Other wave-lengths, less than 600 meters, may be used in special cases, with the approval of the administration which has jurisdiction over the coast and ship stations involved. During the entire time which any coast or ship station is open it should be able to receive signals or calls at its normal wave-length. Boats of small tonnage which cannot conveniently employ wave-lengths of 600 meters for transmission may be authorized to use wave-lengths of 300 meters, but they should be able to receive signals at a wave-length of 600 meters. Communications between two ship stations or between a ship station and a coast station should be exchanged in every case by means of the same wave-lengths, but when communication is difficult the two stations may, in a particular instance and by common accord, pass from the wave-length by means of which they ordinarily correspond to the other regulated wave-length. As soon as the communication is completed they shall resume again their normal wave-length.

The International Bureau publishes and periodically revises an official chart, naming the coast stations, their normal range, the principal navigation lines and the time normally taken by ships to traverse the routes between the different ports. The bureau establishes and publishes the nomenclature of radio-telegraphic stations according to Article I of the convention, as well as periodic supplements containing additions and modification. This list gives general information about each station, including the name, nationality, geographical position or name and nationality of ship, the call letters, normal capacity, radio-telegraphic system employed, length of waves (with normal wave-length underlined), character of service rendered, uses of service, and the coast or ship rate. The exchange of superfluous words and signals is forbidden to stations coming under Article I of the convention. Practice exercises are not permitted except when they do not interfere with the service of other stations, and should be made with a wave-length differing from those used for public correspondence and with the minimum of power. All stations are expected to exchange messages with the minimum necessary power.

All coast and ship stations should comply with the following requirements: (a) The waves sent out should be as pure and as little damped as possible. Direct spark discharges from antennas are not allowed except in cases of distress and also for certain special stations in which the primary power does not exceed 50 watts. (b) The minimum speed requirement is twenty words per minute, the average word being considered to contain five letters. New installations with a primary input of more than 50 watts should be equipped so that it will be readily possible to employ several ranges inferior to the normal range, the weakest being about 150 nautical miles. Old installations having a primary input in excess of 50 watts shall be changed to conform with the new rules as soon as possible. (c) The receiving apparatus should be able to receive wave-lengths provided by the present regulations up to 600 meters, with a maximum protection against disturbances.

Stations employed only to determine the position of ships should not operate within a radius of more than 30 nautical miles. In the case of ship stations power delivered to the radio-telegraphic apparatus, measured by the capacity of the station generator, should not under ordinary circumstances exceed 1 kw; but power capacity greater than 1 kw may be used if the distance from the nearest coast station is greater than 200 nautical miles, or, under exceptional circumstances, if the communication cannot be established except by augmenting the power. Every ship station owned or managed by private enterprise must hold a license from the government to which it belongs, and this license should be honored by all of the contracting governments as indicating the possession of an installation complying with these regulations.

Operators in charge of ship stations should possess a license from the governments to which the vessels belong, or, in case of necessity and for one voyage only, from another contracting government. First-class operators' certificates certify ability to regulate the apparatus and knowledge of its functioning, ability to transmit and receive messages by sound at a rate of not less than twenty words per minute and a knowledge of the Regulations. Second-class certificates will be issued to operators who qualify under the requirements of the first class except in failing to attain the speed requirements. Second-class operators will be allowed on boats which employ radio-telegraphic communication only for their own service and the correspondence of the crew, particularly on fishing boats, and on all boats, under the title of "assistant," provided there is in addition at least one operator holding a first-class certificate. At the ship stations having a permanent service there should be at least two first-class operators in attendance. No one may transmit a message from a ship station except a first-class or second-class operator, except in an emergency. Operators' certificates impose the burden of secrecy in relation to all correspondence. The radio-telegraphic service of all stations is subject to the authority of the captain.

Ship stations having a permanent service or limited hours of service are obliged to have radio-telegraphic installations whose elements are placed under conditions of the greatest possible security. These safeguarded installations should be equipped with an adequate source of power, should be in condition to be placed quickly in service, should be capable of continuous operation for at least six hours and should have a minimum range of 80 nautical miles for ships giving continuous service and 50 nautical miles for those having limited hours of service. This safety apparatus is not required on boats whose regular apparatus already fulfils the foregoing conditions.

Infraction of the convention committed by a duly authorized station is punishable by the administration which has jurisdiction by revoking the license of the operator or the station, or both. In the case of repeated infractions by the same station, when repeated complaints to the administration have had no effect, arbitration is provided for.

II. DURATION OF SERVICE IN STATIONS.

The duration of service in coast stations is to be uninterrupted, as far as possible, day and night. Certain stations, however, may have a limited service. Each administration will fix the hours of service. Coast stations having limited service may not close before having transmitted all the radio-telegrams for ships in their sphere of action, and before having received from such ships all the radio-telegrams announced. Ship stations are divided into three classes: First, those having permanent service; second, those having limited hours of service, and, third, those not having stated hours of rest. During navigation stations of the first category should be always listening; those of the second category should listen during hours of service and also during the first ten minutes of every hour, and stations of the third class are never compelled to listen.

III. THE WORDING AND FILING OF RADIO-TELEGRAMS.

In the transmission of original radio telegrams from a ship at sea, the date and hour of filing at the ship station are indicated in the preface, and in the re-transmission over the telegraphic system the coast station is inscribed as an indication of the station of origin, with the name of the original ship and, if possible, that of the last ship which served as an intermediary. The address of radio-telegrams sent to ships should be as complete as possible, and must conform to certain detailed rules given in the regulations.

IV. COAST CHARGE AND SHIP CHARGE.

The coast charge and the ship charge are fixed according to the charge per word on the basis of a fair remuneration

for the radio-telegraphic work, with an optional addition of the minimum charge per radio-telegram. The coast price cannot exceed 12 cents per word, and that of a ship 8 cents per word. However, each administration has the right to authorize coast prices higher than the maximum in the case of stations having a range exceeding 400 nautical miles or stations operating under exceptionally burdensome conditions. The minimum optional price cannot be more than the coast or ship price of a ten-word radio-telegram. When an original radio-telegram sent from a ship, destined for the land, passes through one or two ship stations, the price includes, besides the charge of the originating ship or coast station and the telegraphic line, the ship price of each boat which has participated in the transmission. The sender of a radio-telegram from an inland station addressed to a ship station deposits the amount of the telegraphic and radio-telegraphic charges, and in addition a sum to cover possible charges at intermediate ship stations. Charges for radio-telegrams from ship to ship, passing through one or two intermediate coast stations, include the ship price on board both ships, the charge at the coast station or stations and the charge for transit between the two coast stations. The charges for radio-telegrams from ship to ship, without the intervention of a coast station, include the two ship charges plus the charge of any intermediate ship. The charges for intermediate ships or coast stations are the same as for stations of origin and destination. The country on whose territory the coast station serves as an intermediary for the exchange of radio-telegrams between a ship and another country is considered, in so far as the charges are concerned, as the country of destination and not as the country of transit.

V. THE LEVYING OF CHARGES.

The total charge for a radio-telegram is collected from the sender, except, at first, in the case of the express charges and, second, in the case of combined or altered words declared non-admissible by the office or station of destination, when these extras are collected from the receiver. Ship stations should carry a list of tariffs on board.

VI. THE TRANSMISSION OF RADIO-TELEGRAMS.

The signals used are to be those of the Morse international code. The international distress signal is to be ...———... repeated at short intervals and followed by the necessary indications.

Distress signals will take precedence over all other communications. Between two stations radio-telegrams of the same rank will be transmitted alternately, one by one, or in a series of several, following the instructions of the coast station, on the condition that the duration of the transmission of each series shall not be in excess of fifteen minutes.

The Regulations prescribe detailed rules at considerable length to govern the procedure in calling from station to station and dispatching messages. Every station which is about to send a message necessitating the use of great power must first send out a warning signal, ——..——, three times in succession, and shall not commence using the increased power until thirty seconds after the warning. As soon as a ship station picks up a coast station it is to indicate its approximate distance, its position, the next port for which it is bound and the number of radio-telegrams awaiting transmission. When a coast station is called by several ship stations simultaneously it decides upon the order in which these stations shall be allowed to exchange their correspondence.

When a radio-te'egram contains more than forty words the sending station interrupts the transmission after each group of twenty words and sends a special signal, awaiting acknowledgment and repetition of the last transmitted word before it continues with the message. Coast stations occupied in transmitting long radio-telegrams should suspend transmission after every fifteen-minute interval and remain silent for three minutes before continuing again. When signals become uncertain it is important to have recourse to all possible expedients for securing transmission. For this purpose a radio-telegram shall be repeated at most three times, at the request of the receiving station. If then the signals are still indistinct, the message will be annulled.

In general ship stations send their radio-telegrams to the nearest coast station. However, if the ship station can choose between several coast stations practically equidistant, it gives preference to that one established on the territory of the country of destination, or to the natural destination of the radio-telegram. A sender on shipboard has always the right to designate to which coast station he wishes his radio-telegram sent, and the ship station then waits until that coast station is the nearest one, but in certain exceptions transmission may be made through more distant coast stations, provided: (a) that the radio-telegram is destined for the country in which this nearest coast station is situated and comes from a ship registered in that country; (b) that the two stations use a wave-length of more than 1800 meters; (c) that this transmission does not interfere with transmission by means of the same wave-lengths by a nearer coast station; (d) that the ship station is more than 50 nautical miles distant from all stations mentioned in the nomenclature. The distance of 50 miles may be reduced to 25 miles, with the reservation that the maximum generator power does not exceed 5 kw, and that the ship's station conforms with the regulations in respect to the character and quality of waves and the allowable power input.

VII. DELIVERING OF RADIO-TELEGRAMS AT THEIR DESTINATION.

If for any reason a radio-telegram coming from a ship at sea and directed to the land cannot be delivered to the addressee, notice of non-delivery is sent out to the coast station that first received the message. The latter in turn transmits the notice to the ship, if possible. If a ship to which a radio-telegram is addressed has not signaled its presence to the coast station within the time limit indicated by the sender, or when there is a delay of more than eight days, the coast station notifies the originating office, which in turn transmits word to the sender.

VIII. SPECIAL RADIO-TELEGRAMS.

The Regulations enumerate several special forms of messages, and stipulations in regard thereto, which will be accepted for transmission. These include radio-telegrams handled by mail over the land portion of their routes.

IX. ARCHIVES.

The originals of radio-telegrams, as well as the documents relating to them kept by the administration, are preserved, with all necessary precaution from the point of view of secrecy, for at least fifteen months.

X. REDUCTIONS AND REIMBURSEMENTS.

In all that concerns reductions and reimbursements application is made of the rules of the International Telegraphic Bureau, with due regard for the present regulations relating to special radio-telegrams. The time consumed in transmission, as well as delays in coast stations awaiting the ship of destination, is not considered in making reductions and reimbursements. If a coast station sends word to an originating office that a message cannot be transmitted to the ship for which it is destined, the administration of the country of its origin demands the repayment of the coast and ship charges to the sender.

XI. CHARGES.

The coast and ship rates have no relationship to the charges provided for by the International Telegraphic Regulations. The charges collected under these rates should

be liquidated by the administration interested. In transmission over telegraphic lines a radio-telegram, from the standpoint of rates, is treated in conformity with the telegraphic regulations. The Regulations provide at some length for international settlements of the charges collected by the various administrations for the transmission of radio-telegrams.

XII. THE INTERNATIONAL BUREAU.

The supplementary expenditures resulting from conducting the International Bureau should not, in all that concerns radio-telegraphy, exceed $16,000 per annum, not including the special expenditures occasioned by the meeting of the International Conference. So far as contributions to expenditures are concerned, the contracting governments are divided into six classes, the members of each class being enumerated in the regulations.

XIII. METEOROLOGICAL AND TIME SIGNALS.

Each government shall take the necessary steps to transmit to its coast stations any meteorological telegrams containing news of interest to the regions in which they are situated. These telegrams, which should not exceed twenty words, are to be transmitted to ships which request such information. The charges for these meteorological telegrams will be paid by the ships to which they are sent. Meteorological observations made by certain ships designated for this work by the countries to which they belong may be transmitted once a day, charged as service notices, to coast stations authorized to receive and transmit them to certain designated meteorological offices. Time signals and meteorological messages will be transmitted in succession, so that the total duration of transmission will not exceed ten minutes, and in general every station whose operation would interfere therewith should be silent during this interval except in the case of distress signals and state telegrams. Each government shall also facilitate communication for the purpose of obtaining maritime information concerning matters of danger to vessels or information of general interest concerning navigation.

XIV. MISCELLANEOUS REGULATIONS.

Messages exchanged between ship stations should be carried on in such a way as not to disturb the coast stations, the latter having, as a general rule, the right of way as regards public communication. Coast and ship stations are to assist in the transmission of radio-telegrams when direct communication cannot be established between the originating station and the destination. The number of retransmissions is limited to two. If a radio-telegram is to be sent partly over telegraphic lines or via radio-telegraphic stations belonging to a non-contracting government, it may be transmitted on the condition that the administration of the government in question has declared itself willing, when possible, to observe the convention and the Regulations, which are indispensable to the regular transmission of radio-telegrams, and upon the further condition that the charges are paid. Modifications of the present Regulations which shall be found necessary in further conferences shall be put in force on the date decided upon by each such conference. The provisions of the International Telegraphic Regulations are applicable, by analogy, to radio-telegraphic communication, in so far as they are not contrary to the present Regulations. For the application of the provisions of the radio-telegraphic regulations, coast stations are considered as stations of transit, except when the Regulations expressly stipulate that these stations shall be considered as stations of origin or destination.

On July 1, 1913, the present Regulations will become effective. These Regulations have been signed by the respective plenipotentiaries and a copy has been deposited in the archives of the British government.

PUBLIC SERVICE COMMISSION NEWS.

NEW YORK COMMISSION, FIRST DISTRICT.

The Public Service Commission, First District, has denied the request of the New York Railways Company and five other street car companies of New York and Brooklyn for permission to operate a line of trolley cars across the Manhattan Bridge over the East River under a temporary permit granted by the Bridge Commissioner Feb. 29, 1912. This action was taken under an opinion by Mr. George S. Coleman, counsel to the commission, holding that the bridge commissioner has no authority to issue such a permit and that all franchises for street-railway operation should be granted by the Board of Estimate and Apportionment.

NEW YORK COMMISSION, SECOND DISTRICT.

The Public Service Commission, Second District, has made an order requiring the Adirondack Electric Power Corporation to show cause before the commission at Albany on Sept. 30 why an order should not be made requiring it to put its plant and transmission lines generally in such condition as would obviate and prevent failures to supply its patrons and customers with electric energy.

NEW JERSEY COMMISSION.

The Board of Public Utility Commissioners has printed and distributed in pamphlet form the proposed rules and regulations for electric-light companies submitted for consideration by the chief inspector of the utilities division. The proposed regulations embrace twenty-nine different items, covering methods of construction, maintenance and operation. It is specified that buildings, machinery and plant must be maintained at all times as required by the National Electric Code. The N. E. L. A. specifications for overhead-line construction, joint pole lines and overhead line crossings are made part of the proposed regulations. A copy of these proposed regulations has been sent to each electric light and power company operating in New Jersey, with notice that a conference will be held at Trenton on Oct. 6 to consider their adoption.

MARYLAND COMMISSION.

Through an order signed last week by the Maryland Public Service Commission, there will practically be a rehearing of the telephone rate case. The order was issued as a result of a petition filed by the Protective Telephone Association of Baltimore. This petition asked that the flat-rate schedule of the Chesapeake and Potomac Telephone Company, which expires Oct. 1, be extended until April 1, 1913. The order provides that arguments shall be heard on Sept. 30 on whether the petition should be granted.

MASSACHUSETTS COMMISSION.

The Gas and Electric Light Commission gave a public hearing last week upon the proposed codification of laws relative to the distribution and sale of gas and electricity, pursuant to an act of the last Legislature. The act provides that the board shall revise, consolidate and arrange the general laws of the State in this connection and recommend any additional legislation deemed necessary in a report to the next General Court in January, 1913. The hearing was preliminary to a more extended discussion to be held at a later date. President Henry I. Harriman of the Connecticut River Transmission Company, Boston, informed the commission that his interests are doing business in three New England states, and that the only way in which the Massachusetts plants can be run profitably under the present laws is by maintaining separate corporations and controlling them by a holding company. He advocated such a revision of the laws that holding companies would be needless and favored the consolidation of the separate properties now existing. Mr. Alton D. Adams,

for the town of Leominster, contended that the small motor customer does not obtain the benefit of the lowest rates for transmitted energy and urged such modification of the laws as would give the commission jurisdiction over the rates of power companies. The hearing was continued to Oct. 21.

OHIO COMMISSION.

The Public Service Commission recently heard testimony and arguments on the application of the Union Gas & Electric Company, of Cincinnati, for authority to issue $500,000 new preferred stock. President James C. Ernst and Attorney J. C. Heintzman appeared for the company, while City Solicitor Bettman was present to oppose the petition. Representatives of the company explained that when the properties of the Cincinnati Gas & Electric Company were taken over on a lease the agreement provided that securities to the amount of $3,000,000 should be deposited with a trustee to insure the terms being carried out. At that time $3,300,000 bonds of the Columbia Gas & Electric Company were deposited, but they have since depreciated until they are worth less than the amount agreed upon. The company wishes to exchange this new issue of preferred stock for a like amount of Columbia bonds and deposit them with the trustee to make good the deposit. The dividends on the stock are to be at the rate of 6 per cent, while the bonds draw 5 per cent interest.

The Mount Vernon Railway Company has made application to the commission for authority to purchase the plant of the Mount Vernon Electric Company for $50,000. The railroad company has been operating the lighting and power plant under a lease for some years.

MICHIGAN COMMISSION.

Commissioner Hemans stated a few days ago that the State Railroad Commission had not been officially notified of the temporary restraining order issued in the case of Edward McGill against the commission and the Home Telephone Company of Detroit to prevent consolidation with the Michigan State Telephone Company. He said that this is necessary in cases of this kind. Attorney James O. Murfin, representing the Bell interests, stated that no notice of the temporary injunction had been served upon his company and that it would proceed with the consolidation, since an injunction had been refused the Home Telephone Company of Grass Lake in the lower courts. However, Attorney Samuel Kelley, acting for the petitioners in the two injunction cases, said that the time allowed for the appeal of the Grass Lake Company has not expired and the case will be taken to the Supreme Court. The Bell interests, he declared, cannot proceed with the consolidation in the face of the temporary injunction, no matter what may be said by their attorneys.

WISCONSIN COMMISSION.

In a decision reviewing the action of the commission in the Appleton water-works case, Judge Park has taken issue with the commission on the subject of franchise values, holding that the commission should have included a franchise value in its valuation of the plant. The result of placing a value on the indeterminate permit, which the decision holds should be done, would be practically to destroy the effect of the public utilities law. It is considered very probable that the Supreme Court will reverse the decision of the lower court.

CALIFORNIA COMMISSION.

On Sept. 7 the Railroad Commission issued a general order requiring all public utilities to file with the commission such rates as depart from the standard schedule because of service rendered in return for right-of-way or at reduced rates to employees, charitable and educational institutions, etc. On Sept. 12 announcement was made that orders are in preparation requiring all utilities to preserve all records and calling upon railroads for monthly statistical reports.

Current News and Notes

RUSSIAN WIRELESS CONFERENCE.—It is reported that the postal authorities of Russia have called a conference for the purpose of formulating regulations for government supervision of wireless stations and the use of radio-telegraphy on foreign ships in Russian waters.

* * *

GOVERNMENT MONOGRAPH ON "COMMERCIAL ORGANIZATIONS."—Trade associations throughout the country will be interested in a bulletin soon to be issued by the Bureau of Foreign and Domestic Commerce of the Department of Commerce and Labor entitled "Commercial Organizations." This will give the results of the activities of seventy-six commercial associations of the United States, with special reference to the development of foreign trade. Other phases of the work of these bodies will also be described, including industrial expositions, methods of developing wholesale and retail trade, municipal publicity, extension of industrial enterprises, etc.

* * *

SURFACE WATERS OF CALIFORNIA.—The United States Geological Survey has published as Water Supply Paper No. 295 a 100-page pamphlet entitled "Gazetteer of Surface Waters of California; Part I, Sacramento River Basin." This gazetteer is the first of a series of reports on the surface waters of California prepared by the Geological Survey under co-operative agreement with the State of California. Part II when it appears will cover the San Joaquin River basin, and Part III will deal with Great Basin and Pacific Coast streams. The stream-flow measurements in these three districts will apear in Water Supply Papers Nos. 298, 299 and 300 respectively, bearing the general title "Water Resources of California."

* * *

PEOPLE'S ELECTRICAL PAGE IN CHICAGO.—The second appearance of the "People's Electrical Page" in Chicago was made on Sept. 17 in the Chicago *Tribune*. Like its predecessors in Chicago and elsewhere, the page is made up of a central portion devoted to electrical miscellany surrounded by the displayed advertisements of electrical business houses. The largest space is taken by the Commonwealth Edison Company. An exceptionally interesting "ad" is that of the Electrical Contractors' Association of the city of Chicago. Here the use of modern electrical conveniences is recommended for the home, and the anouncement concludes with the statement that "the business world to-day concedes that the electrical contractor is the logical man to consult in reference to the installation of these appliances."

* * *

SAN FRANCISCO GAS RATES.—The San Francisco Board of Supervisors recently fixed a gas rate for the city and county of San Francisco, Cal., of 75 cents per 1000 cu. ft. for the fiscal year of 1912-13. This rate was accepted by the Pacific Gas & Electric Company, which serves this community. The action of the board was taken as a result of an exhaustive investigation conducted by Supervisor Adolf Koshland into the company's gas business. The result of this investigation was submitted in a report of the committee on gas lighting and rates to the Board of Supervisors under date of June 17. For the previous year the rate was 80 cents. In the early days the gas rate was as high as $1.25 per 1000 cu. ft., having been reduced in successive steps to $1, then to 95 cents, and still later to 90 cents. The litigation which has always attended the efforts of the Board of Supervisors to reduce rates in former years was absent in the present instance, partly for the reason, it is said, that the present investigation was thorough and exhaustive.

Pennsylvania Utilities Bill Under Consideration.—A public utilities bill was the first of a series drafted by the legislative sub-committee of the Republican State Committee in session at Harrisburg. The bill is framed along the lines of the Tener bill of 1911, but has wider powers and more drastic provisions. It was presented by Mr. William Draper Lewis, of Philadelphia.

* * *

Movement for Electricity Standard in France.—The Minister of Commerce of France is reported to be working on a bill for the further protection of consumers against fraud. Minister David's bill will establish legal standards for electricity, heat, candle-power and other results of modern progress, and those who supply service will have to conform to its standards under the penalty of legal proceedings. Electricity meters and lamps purporting to give certain candle-powers will be among the articles henceforth subject to the same regulations as trade weights and measures.

* * *

Water Resources of the Penobscot River Basin, Maine.—Water Supply Paper No. 279, prepared by the United States Geological Survey, is a 280-page publication entitled "Water Resources of the Penobscot River Basin, Maine," by Messrs. H. K. Barrows and C. C. Babb. This exhaustive paper describes the general features of the basin and presents data on stream flow, the relation of run-off to precipitation, evaporation, floods, low-water conditions, developed and undeveloped water-power, water storage, effect of present storage flow, and log-driving and lumbering. It includes all data that were available at the end of the calendar year 1909 and is accompanied by plans and profiles of the principal rivers, lakes and ponds in the basin, given in Plates XIII to XIX at the end of the volume. The stream flow data for 1910 and 1911 will be published in Water Supply Papers Nos. 281 and 301 respectively.

* * *

Operations of Pacific Gas & Electric Company.—Statistical information presented in a recent announcement of the Pacific Gas & Electric Company of San Francisco contains some facts of interest in showing the extensive operations of this large company. The company has sixteen electric generating plants, including those under construction, with a total rating of 292,573 hp. This rating is divided into 192,973 hp in hydroelectric plants and 99,600 hp in steam generating plants. The overhead transmission and distribution lines total 3289 miles in length, and there are 61 miles of underground lines and 105 substations. The water department reports storage capacity for 50,000,000,000 gal. and 540 miles of irrigation canals, pipe lines, etc. In the gas department there are fifteen plants rated for an output of 40,000,000 cu. ft. per day. There is also a street railway system in Sacramento having 39 miles of track and sixty-two cars. Mr. F. G. Drum is president of the company and Mr. John A. Britton is vice-president and general manager.

* * *

Government Regulation of Wireless Communication at Panama.—In the Panama Canal act signed by President Taft on Aug. 24, which includes the much discussed declaration that "no tolls shall be levied upon vessels engaged in the coastwise trade of the United States," there is rather elaborate provision for the use of wireless communication along and near the canal. Under Section 6 the President is authorized to have such wireless telegraph stations erected and operated at such suitable places along the canal and the adjacent coast as he may deem necessary for the operation and protection of the canal. If necessary, the President is authorized to conduct negotiations for the erection of wireless stations upon the territory of the Republic of Panama. Private and commercial messages will be handled, but government communications will always receive precedence in transmission. The President is also authorized to make such arrangements with private wireless companies as seem in his judgment desirable for the purpose of insuring immunity of the government wireless system from interference by commercial companies.

* * *

SOCIETY MEETINGS.

Indiana Electric Light Association.—Announcement has been made by Mr. J. V. Zartman, secretary, of a change in the date of the annual meeting of the Indiana Electric Light Association. The meeting will be held at Indianapolis on Oct. 30 and 31. The office of the secretary is at 1208 Meridian Street, Indianapolis.

* * *

Electric Club of Chicago.—There was a good attendance at the first-of-the-season meeting of the Electric Club of Chicago on Sept. 19 at the Hotel Sherman, the new meeting place of the club. President A. A. Gray spoke of the co-operative movement started at the Association Island conference, and Mr. William E. Mason, former United States Senator from Illinois, gave a brief talk on "Citizenship."

* * *

Telephone Pioneers of America.—At a recent meeting of the general committee on arangements for the second annual reunion of the Telephone Pioneers of America, it was determined that the second annual meeting will be held at the Hotel Astor, New York City, on Nov. 14 and 15. According to the tentative program, the first day will be given up to a general business meeting in the morning, followed by addresses in the afternoon. In the evening a reception will be given under the auspices of the New York Telephone Society. The second day will be given over to entertainment features and a banquet in the evening. Mr. Henry W. Pope, 26 Cortlandt Street, New York, is secretary and treasurer of the organization.

* * *

New York Jovian Meeting.—The semi-monthly meetings of the New York Section of the Sons of Jove were resumed for the season 1912-1913 with a luncheon at Kalil's Restaurant, New York, on Sept. 25. A representative gathering of nearly 100 electrical men from New York and vicinity was present. Interesting and forceful addresses on the good of the order and the beneficial effect of the work of the Jovians on the co-operative development of the electrical industry were made by Messrs. Corey, Kiefer, De Veau, Becker, Dodd, Christesen and others, all of whom spoke in complimentary terms of the results that have been accomplished by Statesman F. E. Watts in carrying through to success the New York Jovian Lunch Club and the bringing together at these gatherings of men of prominence in all branches of the electrical industry.

* * *

Convention of the New York State Waterways Association.—The third annual convention of the New York State Waterways Association was held in Watertown, N. Y., on Sept. 19 and 20. Delegates were present representing the Merchants' Association of New York City and the city of New York. In view of the very large amount of work which is being done by the State in the enlargement of its canals and the construction of canal terminals, as well as the agitation for the development of water-power, the holding of the convention was of unusual interest. Among some twenty addresses delivered by prominent officials identified with the improvement of waterways and the development of water-power were the following: "Waterways, Water-Powers, and a Fair Deal," by Mr. Howard D. Hadley, of Plattsburg; "Electricity in Canal Operation," by Colonel E. C. Pruyn, of Schenectady, and "How Shall the Greatest Benefit of the Conservation of Water-Power of the State Be Obtained?" by Mr. John C. Parker, of Rochester.

GENERATING ENERGY AT COAL MINES.

The Chignecto Plant of the Maritime Coal, Railway & Power Company, Ltd., of Amherst, Nova Scotia.

Description of the Pioneer Installation for Generating Electrical Energy from Waste Fuel at the Pit Mouth—Energy Transmitted to Neighboring Towns, Mines and Quarries at 11,000 Volts.

THE casual reading of a magazine article a few years ago by Hon. H. J. Logan, formerly member of the Canadian Parliament from Cumberland County, Nova Scotia, was the initial step in the establishment of the pioneer electric transmission plant of the Maritime Coal, Railway & Power Company, Ltd., of Amherst, N. S., at the mouth of the celebrated Chignecto mine, located 8 miles southeast of the latter city and within an easy transmission distance of an important industrial and coal-bearing area. The article in question suggested the possibilities of electrical transmission from the pit mouth, crediting the scheme to Mr. Thomas A. Edison. In company with Senator Mitchell of Nova Scotia, Mr. Logan visited Mr. Edison at his New Jersey home, discussed plans for the carrying forward of the enterprise, and on July 31, 1907, service was begun to the accompaniment of a telegram of congratulation from the great inventor and in the presence of many distinguished guests. The plant has now been in service for over five years and its success has completely demonstrated the practicability of turning the potential energy of slack or refuse screenings into electricity for sale in distant markets. The demand for its output has constantly increased, and to-day the installation is the source of electrical supply for the municipalities of Amherst, Maccan, Nappan, River Hebert, Joggins and Chignecto, operating about sixty motors with a combined rating of 900 hp and a lighting load of about 10,000 16-cp equivalents in the above communities. Factory machinery, a gypsum quarry, pumps, blowers, hoists, fans and other equipment are included in the motor load, and by the use of an otherwise unmarketable fuel which constitutes about 30 per cent of the mine output the plant is enabled to deliver electricity at economical prices throughout the entire district.

The mining areas of the company in the district cover about 5 sq. miles, and the output of the mines at Chignecto and Joggins is now about 800 tons per day, with the prospect of an early increase to 1200 tons. Both domestic coal and steam coal are mined, and the market exists chiefly in

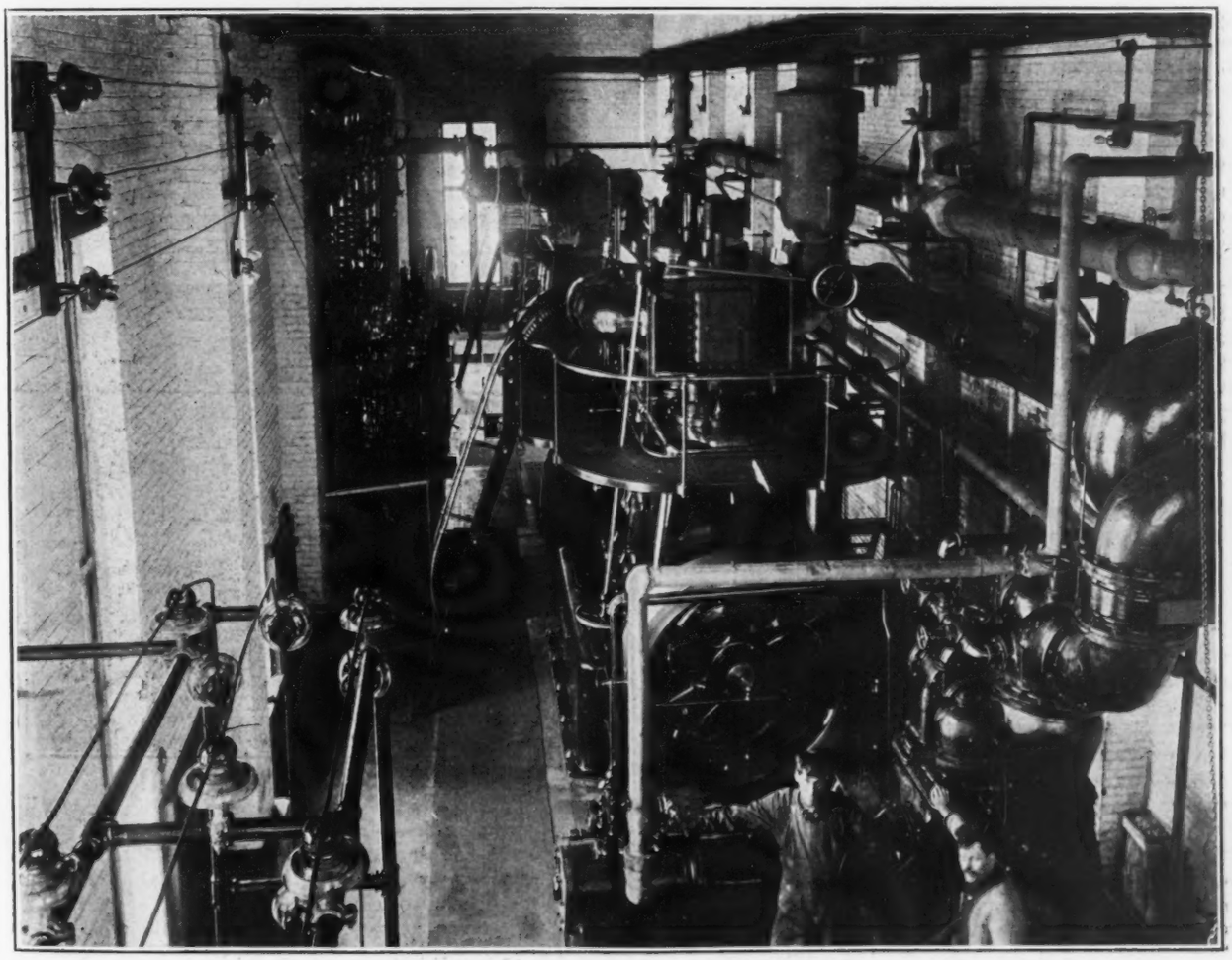


Fig. 1—Interior of Generating Room, Chignecto, N. S.

Nova Scotia and New Brunswick, although a considerable amount of the Joggins slack is sold in the United States. It is estimated that about 12,000,000 tons remain unmined on the property. At the time that the company began to mine the Chignecto seam it was found that the top seam was divided from the bench by a soft ply from 6 in. to 8 in. thick. In the mining process this came out in the form of

Fig. 2—A Home-Made Cooling Tower.

dust or culm and was extremely dirty. During the screening this material became mixed with the slack, lowering the quality of the latter to such an extent that the slack was of very little marketable value on account of the large amount of ash present. It cost the company about 10 cents per ton to dispose of the material, so that the saving in converting the fuel energy of this cheap grade of coal into electricity is much greater than if a good quality were used, as the rate per ton for conveyance to the boiler room is the same in both cases. The fuel used at the plant could not be sold on account of its quality, and the space for banking was limited to an area close to the mine. The Joggins culm is cleaner in character than that at Chignecto, and some of this is marketed, but experience at the plant indicates the desirability of utilizing all the culm from this mine as soon as the load warrants it.

The power plant is a 75-ft. by 100-ft. brick and steel structure with concrete foundations and is located within about 100 ft. of the colliery bankhead, fuel being delivered to the station from screens at the bankhead by a Jeffery motor-driven conveyor which discharges into a steel-lined overhead wooden bunker of 250 tons capacity above the firing aisle of the boiler room. From the bunker the coal is fed to the boiler batteries through inclined swinging chutes discharging into the hoppers of Jones underfeed stokers. The boilers are installed on one side of a single firing aisle with a dividing well at their rear, the engine room being located on the opposite side of the latter. Eight 150-hp Robb horizontal return tubular boilers are in service, four batteries being installed. Two sets of blower engines and fans are provided, either being capable of giving 5 in. of draft in the ash pit with all boilers in operation. Natural draft is also provided by a steel stack 60 in. in diameter and 40 ft. high, with a lower section of brick designed to receive the products of combustion from a breeching leading outward from the boiler room. The stokers are capable of supplying fuel to boilers of 250-hp individual rating. Ashes are disposed of by a car running on a track in front of the furnaces, the car discharging into freight cars of the Intercolonial Railway. The ash track is brought out of the boiler room on the south side of the station and is immediately swung around 90 deg. and stub-ended across two steel I-beams which span the railway track below. Coal enters the power house on the same side through a gallery housing the conveyor above mentioned. The fuel burned averages 20 per cent ash, and when using this culm and refuse the fires have to be cleaned every two hours. The grate areas of the boilers were designed for 49 sq. ft. each, somewhat above the usual practice on account of the poor quality of the fuel. The boiler room is provided with an ample supply of daylight, as the firing aisle borders on six large windows in the exterior view.

Feed and condensing water for the plant is obtained from an artificial pond about 1000 ft. above the power house, the pond being 1000 ft. long, 600 ft. wide and 10 ft. in average depth and held in position by an earth dam which crosses a narrow gulley at the foot of the lake. The water level at the dam equals the height of the basement beneath the boiler room. The water is brought to the station in a cast-iron pipe discharging into concrete wells in the basement, and the feed water and injection water supplies are taken from these wells. Ordinarily the feed water is taken from the condenser discharge pipes and is delivered to the boilers on the front sides after passing through a 1000-hp Cochrane open heater and an installation of two Canada Foundry Company feed pumps. A 2-in. Penberthy injector is in service during emergencies. About a mile above the power house a second dam of wooden construction, 125 ft. long and 20 ft. high, has been built on St. George's Creek, and it is estimated that about 2,000,000 gal. of water is held back by this. The total supply of water available for feed and condensation purposes is 6,000,000 gal. At the upper dam a small pump house has been built, with a turbine pump, motor and transformer installation arranged to supply water to the intake wells as specially required. The motor is operated by an 11,000-volt service from the generating station, control being through a switch in the plant. Steam is supplied to the bankhead from the boiler room for pumping and hoisting service, the installation shutting down an old boiler plant and saving the wages of two firemen, a machinist and a helper.

The steam and feed-water piping and fittings are of extra heavy design, all joints being packed with corrugated copper gaskets. Each boiler is connected with an 8-in. steam main at the rear of the boiler room through a 6-in.

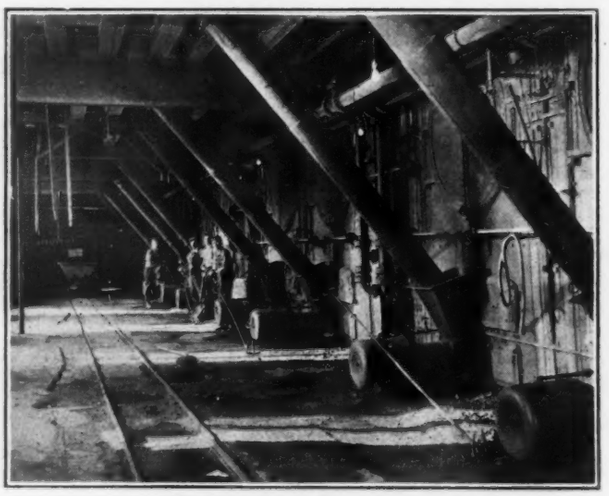


Fig. 3—Boiler Room, Chignecto, N. S.

riser. From the main leads 7 in. in diameter are run to the engines. The working steam pressure is 150 lb.

Two 500-kw, three-phase generators are at present in service, each being direct-driven by a 17-in. by 33-in. by 16-in. Robb-Armstrong vertical, center-crank, cross-compound engine operating at 300 r.p.m., on a 26-in. vacuum, and having 13-kw and 20-kw outboard-hung direct-con-

nected exciters. These engines are among the largest vertical-type machines ever built in Canada and are designed for automatic governing within 3 per cent maximum on momentary changes of load. Each engine exhausts through a 14-in. pipe into a 14-in. by 20-in. by 24-in. twin horizontal jet condenser and air pump of Canada Foundry Company's design, the condensing units being located on the engine-room floor beside the engines. The engine room is about 20 ft. wide, but is not unduly crowded even with the arrangement of equipment shown in the photograph. The engine bearings are fitted for water cooling, and each unit is equipped with a forced system of bearing lubrication. On the acceptance test this equipment operated with the following steam consumptions at the loads given below:

	TOTAL INDICATED HP.				
	471.5	797	873	958.5	1014
Lb. steam per indicated hp-hr.	17.8	15.4	14.9	15.6	16*
Corresponding to 26-in. vacuum, lb. steam	16.68	14.4	14.03	14.48	14.75

*Vacuum 21 in. to 22.5 in.

The generators were built by the Canadian General Electric Company, one being wound for 420 volts and the other for 11,000 volts. Sixty-cycle current is delivered from each unit to a main switchboard located at the east side of the engine room parallel to the outer wall of the building. The switchboard at present consists of six marble panels, two being assigned to the generators, one to a Tirrill regulator and three to oil switching equipment controlling the outgoing service, which is at 11,000 volts, three-phase. The panels are provided with the usual synchronizing equipment, and the layout of the engine room is such as to permit an easy expansion of the plant northward in the future. It is probable that a new 1000-kw unit, probably a turbo set, will be installed at an early date. A 4-ton hand-operated crane spans the engine room and serves its entire area. Below the engine room are carried two discharge pipes 10 in. in diameter from the condensers to the first dam above the power house, at which point the condensate is returned to

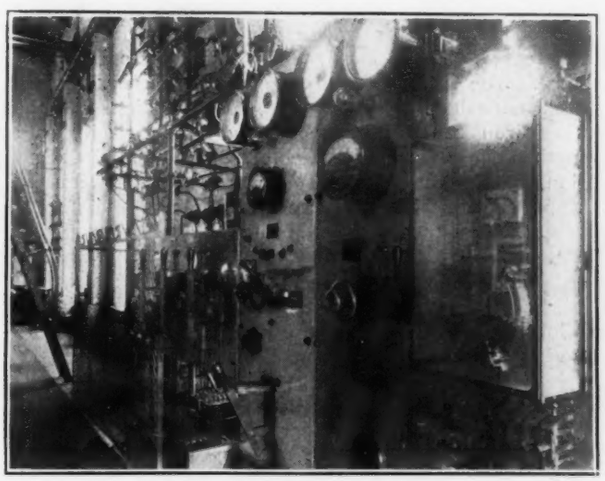


Fig. 4—Switchboard at the Chignecto Plant.

the pond. A home-made cooling tower designed by Mr. W. Cooke, chief engineer of the station, is in use at this point. It consists of two inclined decks about 30 ft. long, the upper deck being bored with holes 3/16 in. in diameter and 2 in. apart on centers. Water is discharged upon the upper deck at the head of the tower from the condenser delivery pipes and thrown back into the pond, part leaving the flume in the form of thin sprays falling from the upper to the lower, or solid, deck, and the rest leaving in a stream at the end of the upper deck as shown. The flume is built of 2-in. by 4-in. wooden planking and is braced by bents at three intermediate points. The upper deck has a drop of about 4 in. in 30 ft., while the lower deck drops about 4 ft. in a slightly longer distance. To avoid washing down the

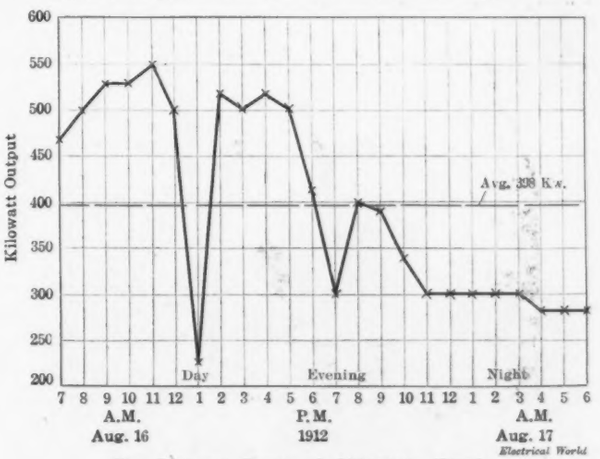


Fig. 5—Load Curve of Chignecto Plant.

surrounding stream bank, the upper deck is made 2.5 ft. wide at the upper end and 6 ft. wide at the lower end, compared with 3-ft. and 7-ft. widths in the lower portion of the structure. The discharge water is cooled about 4 deg. C. in passing over and through the tower, and as the cost of the device and expense of operating it are negligible, there results from its use a positive though moderate economy in the use of injection water.

The local load at Chignecto is handled by a 2200-volt service. From the power house two 11,000-volt overhead lines are run separately to the principal centers of distribution at Joggins and Amherst, each line being built of No. 4 B. & S. copper carried on 15,000-volt porcelain insulators supported on 30-ft. wooden poles spaced 125 ft. apart. The pole lines are each designed for a second circuit, but at present Joggins and Amherst are supplied by one circuit each. Where the lines cross tidal streams the usual practice is to set two poles close together and employ a 3/8-in. steel cable for the conductor. At these spans the poles are fitted with double fixtures having four insulators at each end of the span, the spans varying from 400 ft. to 700 ft. in length. At points where the line crosses the track of the Intercolonial Railway the line conductor used is 300,000-circ. mil cable. The poles at these crossings are all set in concrete with an overhead network designed to establish a short-circuit in case the cables break. The Joggins line is about 15 miles long and supplies the Joggins, Maccan and River Hebert district. All the machinery at the Joggins mines is now electrically operated, distribution being at 220 volts alternating current. The largest motor on this line is rated at 95 hp and drives a ventilating fan for the mining service. The Amherst line supplies energy for all the lighting and motor service in the town, and from this transmission circuit a tap is taken off at Nappan for the Maritime Gypsum Company, a modern substation for voltage conversion and local distribution being situated at the mouth of the quarry. Previous to the installation of electric service the gypsum quarry was not a commercial success, but the use of electricity has turned the enterprise into a profitable one. Local service at Amherst is handled through a two-story 12-ft. by 12-ft. substation. On the upper floor are placed self-cooling transformers reducing the potential to 2400 volts for local use, fuses, switches and low-equivalent lightning arresters. The lower floor contains 2400-volt oil circuit-breakers controlling the local feeders. An old direct-current station of small equipment and very limited

distribution area was shut down by the entrance of the Chignecto service into Amherst, which is a city of about 9000 inhabitants and an active manufacturing community. Among the larger customers of the Maritime interests at Amherst are the McLean Milling Company, Canada Car & Foundry Company, Robb Engineering Company Works and Hensen Wool Goods Company. Day and night service is

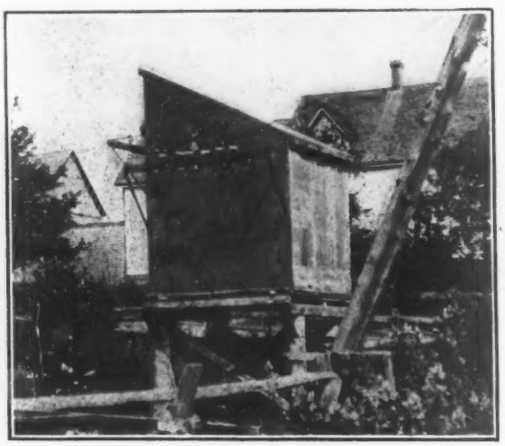


Fig. 6—Local Transformer House.

given to all the municipalities reached by the Chignecto plant, and in the outlying districts energy is supplied through local transformer stations of an inexpensive sheet-iron fireproof type, usually mounted out of doors on piling or other wooden foundations.

The operation of the Chignecto plant requires a force of ten men. Two shifts are run, these being thirteen and eleven hours in length, with alternate assignment of employees to long and short runs. In the daytime the fire room requires two firemen, one ash wheeler and one man to blow out tubes and clean the boiler combustion chambers.

TEST OF CHIGNECTO BOILER, BURNING REFUSE CULM.

Duration of test, hours	7
Grate surface, in square feet (Jones' underfeed stokers)	42
Total square feet boiler heating surface	1605
Ratio water-heating surface to grate area	38.1 to 1
Average boiler pressure, lb. per square inch	143.3
Absolute pressure, lb. per square inch	158
Average air pressure in ash pit, inches water	4.65
Average temperature external air, deg. Fahr.	25
Average temperature fire room, deg. Fahr.	50
Feed-water temperature, deg. Fahr.	157.3
Total amount of coal from pile (Chignecto culm), lb.	5506
Moisture in coal, per cent.	3.1
Total dry coal, lb.	5534
Total dry weight ashes and clinkers, lb.	1567
Proportion of ashes and clinkers, per cent	29.4
Total loss in coal from all causes, lb.	1739
Total combustible fuel, lb.	3767
Total feed water, lb.	31,358
Equivalent water evaporated from and at 212 deg. Fahr. per pound of coal from pile, lb.	6.291
Equivalent water evaporated from and at 212 deg. Fahr. per pound of combustible, lb.	9.196
Coal burned per square foot grate surface per hour, lb.	18.72
Combustible per square foot grate surface per hour, lb.	12.81
Water evaporated from and at 212 deg. Fahr. per square foot grate surface per hour, lb.	117.8
Above, per square foot heating surface per hour, lb	3.083
Average hp developed	143.4
Moisture in steam, per cent.	0.73
Approximate heat units in 1 lb. coal from pile as accounted for in water	6078

At night two firemen and an ash wheeler handle the service. In the engine room the chief engineer and an assistant engineer handle the day load, the night shift being carried by one assistant engineer. A typical load curve of the station for a recent August twenty-four-hour run is given herewith, the average output for the period being 398 kw and the station load-factor 72.5 per cent. The labor requirements are somewhat increased by the care needed to burn successfully the poor fuel offered, without decrease in steam pressure. The installation is at present producing energy upon a fuel consumption of about 6.5 lb. per kw-hr. The average loads upon the plant during the past eight months have ranged from 323 kw to 398 kw. About 40 tons of refuse slack is burned per day at present.

The accompanying data are taken from a test conducted upon one of the 150-hp boilers of the plant by Mr. Philip A. Freeman, of Halifax, N. S., consulting mechanical engineer.

The consulting electrical engineer in charge of the work at Chignecto was Mr. Julian C. Smith, Montreal, the general manager of the company being Mr. David Mitchell.

REINFORCED CEMENT AND CONCRETE POLES FOR OVERHEAD ELECTRIC LINES.

By Alfred Still

As a substitute for the familiar wood poles supporting overhead wires, steel poles of the tubular form and latticed steel masts are used. The full advantage of the galvanized or painted steel structure is best realized in the high towers with extra wide spacing, such as are used for the transmission of electric energy at high pressures. The use of Portland cement for molded poles of moderate height, to be used in lieu of wood poles on the shorter spans, is by no means new; the experimental stage has long ago been passed, and with the deplorable but no less rapid depletion of our forests and the incomparably longer life of the concrete poles, these will probably be used in largely increasing numbers during the next few years.

There is much to be said in favor of the wood pole when the right kind of timber, properly seasoned and treated, is used; but, apart from the general unsightliness of wood poles in urban districts, their life is uncertain and always comparatively short. In Switzerland the experiment has been tried of covering the ordinary wood pole with concrete mortar about 1 in. thick. The strength, and especially the life, are greatly increased thereby, as the decay which so frequently occurs at ground level will be largely, if not entirely, prevented; but it is doubtful whether the system will in the long run prove satisfactory or economical. The ideal material to use for reinforcing concrete is undoubtedly steel or iron. Longitudinal rods or bars of iron can be placed exactly where required to strengthen those parts of the pole section that will be in tension, and the concrete, filling up the spaces between the reinforcing rods, takes the place of all bracing and stiffening members of the ordinary steel structure in an almost perfect manner. It is probably at this time generally admitted that iron embedded in cement will last almost indefinitely without suffering any deterioration. When excavating for the foundations of the new General Post Office in London, England, some old Roman brickwork was discovered in which the hoop-iron bonds were still bright and in perfect condition. The life of a concrete pole is, in fact, almost unlimited, a consideration which should not be overlooked when estimating the relative costs of different kinds of supporting structures. It requires no painting and practically no attention once it is erected. If any small cracks should at any time develop, they can readily be filled with cement.

An unlimited life is not necessarily an unmixed blessing; in the case of a badly or inharmoniously designed pole it might be considered a disadvantage. On the other hand, the concrete pole, with its inexpensive requirements in the matter of molds, can easily be so designed as to harmonize with its surroundings, and undoubtedly much might be done

with concrete poles in our larger cities to mitigate the unslightly and inartistic effect of overhead lines until such time as it may be found possible or expedient to put all such wires underground. By making the interior of the poles hollow connections can readily be made between overhead wires and conductors in underground conduits, without any unsightly attachment to the outside of the pole.

While referring to the advantages of the cement pole it may be added that every pole is virtually a lightning rod, an advantage which it shares with the steel pole or tower. On lines where both timber and concrete poles have been used and where many wood poles have been shattered by lightning the concrete poles have rarely been struck. There is an instance of a concrete pole of the Marseilles (Ill.) Land & Water Company having been struck, but the only damage done was the chipping out of a small piece at the top of the pole and one at the bottom where the current entered the ground after following down the steel reinforcing bars inside the pole.

The weight of concrete poles is necessarily considerable, and unless they are made on or near the site where they will be erected the cost of transportation would generally be prohibitive. Some data given by Mr. George Gibbs in a paper read before the American Soclety of Civil Engineers and abstracted in the *Electrical World* in the issue of Sept. 2, 1911, may be of interest. The concrete poles he refers to are erected on the Meadows division of the Pennsylvania Railroad, the average spacing being 120 ft. The total (over-all) lengths varied between 35 ft. and 65 ft. The specification called for poles to withstand a transverse loading of 6000 lb. applied 6.5 ft. below the top. The cross-section of the poles is a square with chamfered corners, the taper being 1 in 120. The weight of a 35-ft. pole without fixtures was 5300 lb., while that of the 65-ft. pole was 17,300 lb. These weights are in excess of what would ordinarily be required because, the foundations being poor, the portion of the pole buried in the ground is abnormally long.

It is probable that the concrete poles of cross-country transmission lines are usually made somewhat heavier than the strength requirements necessitate because, being molded on the site, not always with the best and most convenient appliances, they are made solid throughout or through a large part of their length, whereas a hollow construction would have been adopted had suitable collapsible cores been available.

Poles up to 35 ft. in length are usually molded in a horizontal position, the forms being removed after three or four days. After a period of seasoning lasting from two to three weeks they are erected in the same manner as wood poles.

Poles longer than 35 ft. are best molded in a vertical position; in fact, it is possible that this method may be found advantageous even in the case of shorter poles. The forms are set up immediately over the hole previously prepared for the pole base. They are set truly vertical and temporarily guyed, the reinforcing inside the form being held together and in position by whatever means of tying or bracing may be adopted. Sometimes iron wire is used, but more uniform results are obtained by using specially designed iron distance pieces with the required spacing between them. The concrete is raised to the top of the mold by any suitable and economic means (preferably direct from the concrete mixer by an arrangement equivalent to the ordinary grain elevator) and is dropped in. By this means the hole in the ground is entirely filled with concrete. No tamping is required, a firm hold being obtained, since the ground immediately surrounding the concrete base has not been disturbed.

The best quality of crushed stone and sand should be used, the usual proportions being: cement, one part; sand, two parts; crushed stone, three or four parts, not too large to pass through a ¾-in. screen. When gravel is used the mixture may be one part of Portland cement to five parts of gravel, provided that the latter is graded, including sand, and with the largest pieces of a size to pass through a ¾-in. screen.

The cost of concrete poles does not compare unfavorably with that of other types of poles. The manufacturing cost of a 35-ft. pole may be as low as $8.50, but $9.50 would be a safer figure to allow for estimating purposes. A 40-ft. pole might cost from $15 to $20, while for a 50-ft. pole containing about 50 cu. ft. of concrete from $25 to $30 should be allowed; but the cost will depend much on local conditions and the method of manufacture. An increased initial expenditure on convenient and economic forms and suitable manufacturing plant will usually lead to reduction of total cost.

When designing a concrete pole to withstand a definite maximum horizontal load applied near the top, the pole is treated as a beam fixed at one end and loaded at the other. The calculations are very simple if certain assumptions are made, these being as follows:

(1) Every plane section remains a plane section after bending.

(2) The tension is taken by the reinforcing rods.

(3) The concrete adheres perfectly to the steel rods.

(4) The modulus of elasticity of concrete is constant within the usual limits of stress.

The ultimate crushing stress of the concrete may be taken at about 2200 lb. per square inch. The reinforcing bars should be covered with concrete to a depth of not less than 1 in. The effect of keeping the reinforcing bars under tension while the concrete is poured in the mold and until it has hardened sufficiently to support the strain itself has been tried and found to improve the performance of the poles, but it is doubtful whether the extra apparatus and labor required are justifiable on economic grounds. When subjected to excessive load a concrete pole will generally yield by the crushing of the material in the base near ground level; but, unless it is pulled out of its foundations, it will not fall to the ground.

The comparative rigidity of concrete poles cannot be said to be a point in their favor, as the flexibility and elasticity of wood poles and some forms of steel structures are features of undoubted advantage under certain conditions. On the other hand, the degree of deflection of concrete poles before breaking is remarkable. The elastic limit is variable, and no exact figure can be given for the elastic modulus of cement concrete; but for a 1:2:4 mixture 3,000,000 may be taken as a good average figure for approximate calculations. For cinder concrete this coefficient may be as low as 900,000.

Some tests made on 30-ft. concrete poles gave deflections of from 3 in. to 4 in. at a point near the top of pole, when submitted to a test load equal to about double the maximum working load.* Another series of tests made recently in England on some 44-ft. poles of hollow section, 17 in. square at the base and 8 in. square at the top (inside dimensions 13 in. and 4 in. respectively), with loads applied 38.5 ft. above ground level, gave a deflection of 66 in. under a horizontal load of 10,500 lb., and the permanent set on removal of load was 21 in. The pole did not fail completely until the deflection was 78 in.

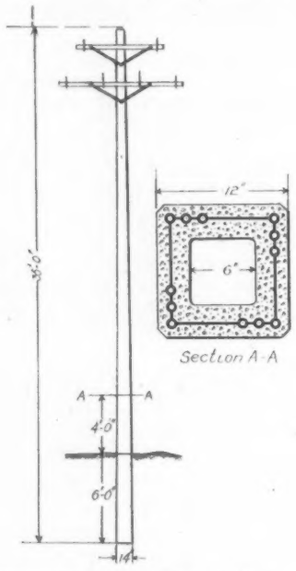
As examples of concrete-pole lines, the transmission line of the Northern Illinois Light & Traction Company, of Marseilles, Ill., and the 42-mile, 33,000-volt line of the Empreza Luz e Força da Ribeirão Preto, Brazil, may be mentioned. The Northern Illinois company transmits three-phase energy at from 30,000 volts to 33,000 volts. Most of the poles used by it are about 30 ft. high, spaced from 125 ft. to 132 ft. apart. The section is square, with 6-in.

*These poles were probably of large cross-section. Some tests made on poles measuring 10 in. square at the base and 32 ft. high gave a deflection of just over 2 ft. with a horizontal load of 2000 lb. applied near the top.

sides at the top of the pole and 9 in. at the base. The reinforcing consists of six ½-in.-square steel bars through the entire length of the pole. Many of the concrete poles on this line have now been in position over four years, and they have given entire satisfaction.

In the matter of supporting distributing lines in cities it may be stated that upward of 1000 concrete poles have been erected for this purpose in Oklahoma City during the last four years. These poles are mostly 35 ft. high, of hexagonal section, 7 in. wide at top and 16 in. at the base. They are hollow, with walls about 2¾ in. thick, and they weigh 2000 lb. each.

The accompanying illustration shows a typical concrete pole of hollow section suitable for carrying six transmission wires on two wooden cross-arms. The pole is 35 ft. long over all, about 6 ft. being buried in the ground. With a top measurement of 7 in. square and a taper to give an increase of 1 in. width for every 5 ft. of length, the size at the bottom will be 14 in. square. The drawing shows a section through the hollow pole taken at a point about 4 ft. above the ground level. Iron spacing pieces, as here shown, or their equivalent, must be placed at intervals to hold the longitudinal steel reinforcing bars in the proper position.



Dimensional Plan and Section of Concrete Pole.

The number of rods will vary with the distance below the point of application of the load. The bending moment to be resisted at every point being known and the taper of the pole decided upon, the amount of reinforcing required at any given section is easily calculated. The weight of a pole as illustrated would be about 2700 lb. without fixtures. The reinforcing rods and spacing rings would account for approximately one-seventh of the total weight. A factor of safety of four is generally employed in strength calculations of reinforced concrete poles.

COAL ANALYSES.

During the last six years a large number of coal analyses have been made from samples from time to time collected from various fields by members of the United States Geological Survey, but for one reason or another the results have not hitherto been published. In a twenty-nine-page pamphlet entitled "Miscellaneous Analyses of Coal Samples from Various Fields of the United States," issued by the United States Geological Survey, Department of the Interior, as Bulletin 471-J, the results of the analyses referred to are given in a series of forty-eight tables. These tables cover samples taken from many mines.

THE CRANK DIAGRAM FOR REPRESENTATION OF ELECTRICAL POWER.

Comparison of Cycle and Integral Diagrams for Showing Values of Current, Voltage and Power in Alternating-Current Circuits.

By Albert A. Nims.

In view of the decision of the International Electrotechnical Congress at Turin in favor of the "crank diagram" method of representing alternating-current quantities by vectors, it is of interest to develop a general form of this method and to note its close connection with the method of representation by means of an intercepting circle or "polar diagram," as it is often called, and as it will be referred to in what follows.

In Fig. 1 is shown an ordinary crank diagram, in which the line OE represents some sinusoidal emf; instead of dropping a perpendicular upon the Y-axis in order to determine Oy_e, the instantaneous value at the phase indicated, describe upon OE as a diameter a circle which shall rotate with it. Then, by geometry, that part of the Y-axis within the circle is the projection of OE, and therefore represents the instantaneous value of the emf. This is true at all phases, a negative value being represented, of course, when the Y-intercept is below the X-axis.

The diameter OE is merely one instantaneous value, the maximum, of the function, of which a complete cycle is represented by the complete circle. The circle passes through the origin and rotates counter-clockwise about it. For a function whose value is zero at zero time the initial position of the diameter OE is in the X-axis; for any other initial value the rotating diameter starts from a position which is at the proper angle ahead of the X-axis or behind it. The value of the Y-intercept is

$$Oy_e = e = OE\,[\sin(\omega t + \alpha_1)] = E_m \sin(\omega t + \alpha_1) \quad (1)$$

In this equation all letters have their usual significance, α_1 being the epoch of the function, or its phase at zero time.

A lagging current developed in a circuit by this emf is represented by another rotating circle, of which the diameter, OI, is not so far advanced in the direction of rotation as OE (Fig. 2). The value of the Y-intercept of this circle is

$$Oy_i = i = OI\,[\sin(\omega t + \alpha_2)] = I_m \sin(\omega t + \alpha_2), \quad (2)$$

α_2 being the epoch of the current function.

With the same facility as sinusoidal functions, non-sinusoidal functions may be represented by similar means. Thus, in order to obtain the triple-peaked wave of Fig. 3, the curve of Fig. 4 is rotated counter-clockwise about the origin and the Y-intercepts are plotted to rectangular co-ordinates against time of rotation. Each different wave shape in rectangular co-ordinates has, in polar co-ordinates, an equally distinct intercepting curve, which may naturally

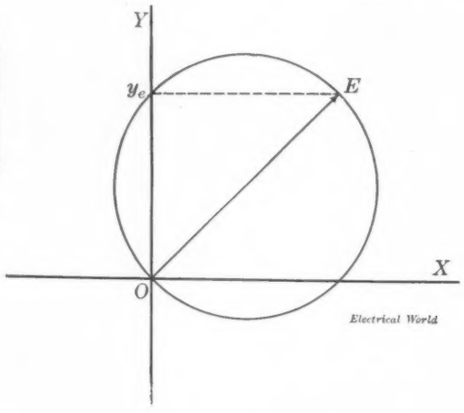


Fig. 1—Ordinary Crank Diagram.

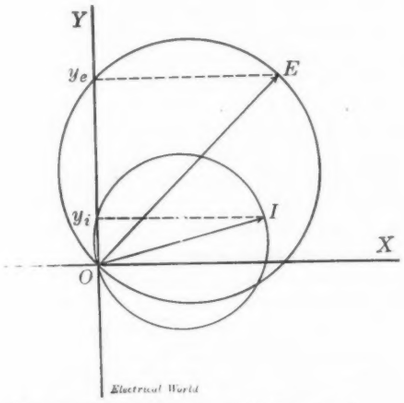


Fig. 2—Cycle Diagram of Voltage and Current.

be termed the characteristic curve of the function. From this characteristic curve can be determined the circle representing the equivalent sine wave.

Non-sinusoidal emf waves are known to be equivalent to the superposition of odd harmonics upon a fundamental wave, and the instantaneous value of a non-sinusoidal wave is

$$e = E_m \sin \theta + (E_m)_3 \sin 3\theta + (E_m)_5 \sin 5\theta + \ldots \quad (3)$$

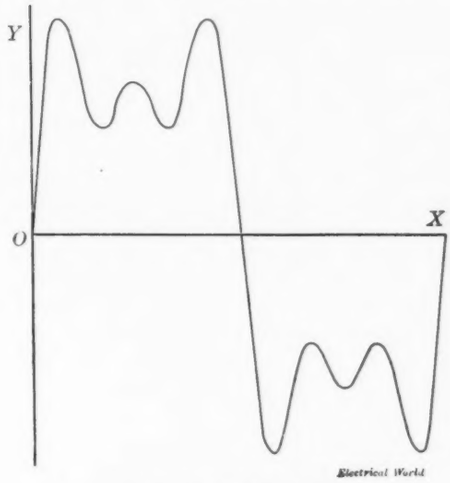


Fig. 3—Triple-Peaked Wave.

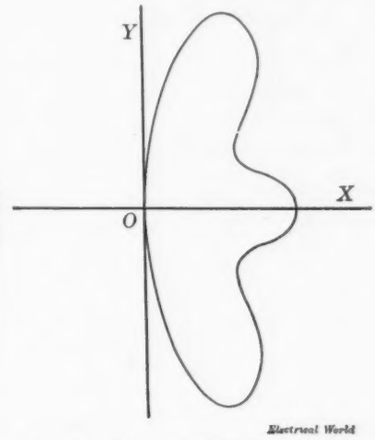


Fig. 4—Curve to Generate Triple-Peaked Wave by Rotation.

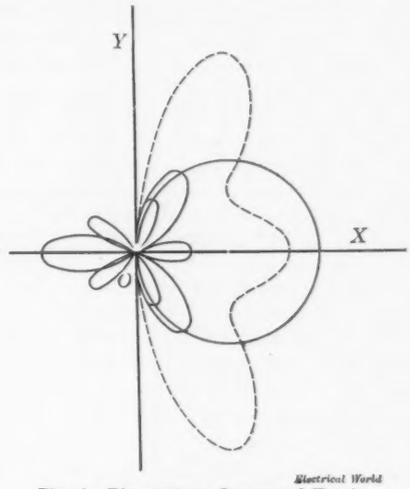


Fig. 5—Elementary Curves of Triple-Peaked Wave.

Visual interpretation may be given to this expression by plotting, to either polar or rectangular co-ordinates, all the curves represented by the expressions on the right-hand side of the equation and adding their simultaneous values to produce the characteristic curve of the non-sinusoidal wave. The actual expression for the wave of Fig. 3 is

$$e = 42 \sin x + 21 \sin 3x + 14 \sin 5x, \quad (4)$$

and the curves up to the fifth harmonic are plotted in Fig. 5.

The general form of the expressions in equation (3) is, in terms of analytic geometry,

$$r = a \sin n\theta, \quad (5)$$

where θ is the variable angle and a and n are constants. This equation represents a family of closed curves, clustered about the origin, each one having a different number of lobes, according to the following rule, as illustrated in Fig. 5: When n is even the number of lobes is $2n$; when n is odd the number of lobes is n.

It is generally true, especially with sine waves, that one is more concerned with each wave as a whole than with the instantaneous values of any of them. In such cases, since the characteristic circles are fully determined as to size and position by the length and position of their diameters, the diagram can be simplified by omitting the circles and retaining only their diameters, which may be shortened to the scale of the effective values and which may be properly spoken of as vectors. Thus, shorn of its lines of beauty, Fig. 2 becomes the orthodox crank diagram of Fig. 6, which represents the effective values and time-phase positions of a sinusoidal emf wave and a sinusoidal current wave. The diagrams in which the characteristic curves are retained will be spoken of herein as "cycle" diagrams, and those in which simply the diameters of the intercepting circles are used as "integral" diagrams.

The "crank diagram" may now be regarded as a special case of a general intercepting curve method of graphically representing periodic functions. The limitations which make it a special case are two: First, it is an integral diagram and, second, it is confined to the representation of sinusoidal functions. The general intercepting curve method to which it belongs differs from the "polar diagram" intercepting curve method in only one particular, as will now be shown.

Let the circle of Fig. 1 be brought to a standard position, so that its diameter coincides with the X-axis, as in Fig. 7. If, instead of rotating the circle counter-clockwise from this position, a radius vector, or time axis, is started from the X-axis and rotated counter-clockwise, the lengths intercepted by the circle will represent the same sine wave as the intercepts obtained by rotating the circle, but with a lead of a quarter period. A lagging function must be represented by another circle with its diameter in the first quadrant (Fig. 8), or farther advanced in the direction of rotation than the diameter of the leading function. If the circles be dropped from this diagram, there is obtained (Fig. 9) the vector diagram, according to the "polar diagram" method, of a leading emf and lagging current.

The relative rotation between the axes and the curve necessary for obtaining the instantaneous values of the function represented in Fig. 7 may be obtained by manipulating the figure in four different ways: by fixing the axes and rotating the circle about the origin either (1) counter

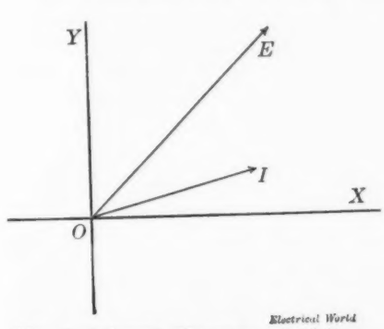


Fig. 6—Integral Diagrams of Voltage and Current.

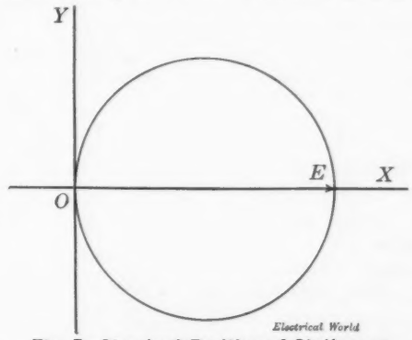


Fig. 7—Standard Position of Stationary Circle.

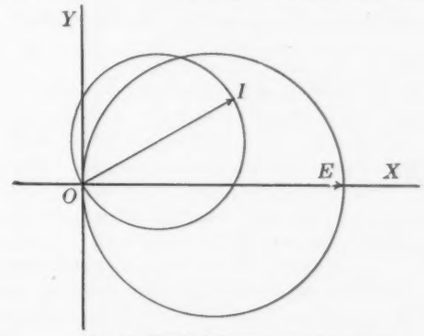


Fig. 8—Cycle Diagram of Lagging Current.

clockwise or (2) clockwise, or by fixing the circle and rotating the axes, (3) counter-clockwise or (4) clockwise. It is evident at once that the first method is the general form of the crank diagram, and that the third is the "polar diagram" method. In both, be it noted, there is an intercepting circle and the rotation is counter-clockwise; the only difference is in what rotates. The International Electrotechnical Commission has decided, by indicating its choice between the two forms of resulting integral diagrams, that it shall be standard practice to rotate the circle. Methods (1) and (4), also (2) and (3), are exact negatives of each other, and may, without affecting the representation, be used interchangeably, as is sometimes convenient from the standpoint of graphical construction.

The principle of the intercepting curve may be extended and made to include a cycle diagram of power in the following manner: With the circles of Fig. 2 fixed, rotate the axes clockwise, plotting upon each position of the Y-axis the product of its intercepts with the two circles. The locus of these points is the four-lobed curve of Fig. 10. If the axes be now restored to their original position and all three curves rotated counter-clockwise about the origin, the Y-intercepts will represent instantaneous values of power as well as of emf and current. These intercepts when plotted to rectangular co-ordinates give the familiar waves of Fig. 11.

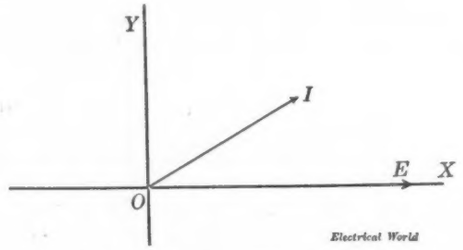


Fig. 9—Polar Diagram of Lagging Current.

The equation of the power curve of Fig. 10 is derived as follows:

$$p = ei = E_m \sin(\omega t + \alpha_1)\, I_m \sin(\omega t + \alpha_2) \quad (6)$$

$$= \frac{E_m I_m}{2}[\cos(\alpha_1 - \alpha_2) - \cos(2\omega t + \alpha_1 + \alpha_2)] \quad (7)$$

$$= EI\,[\cos(\alpha_1 - \alpha_2) - \cos(2\omega t + 2\alpha_2 + \alpha_1 - \alpha_2)]. \quad (8)$$

Denoting $\alpha_1 - \alpha_2$, the phase difference between emf and current, by θ,

$$p = EI\,[\cos\theta - \cos(2\omega t + 2\alpha_2 + \theta)]. \quad (9)$$

If α_2 is zero—that is, if the current circle is in standard position, as is generally the case—equation (9) becomes

$$p = EI\,[\cos\theta - \cos(2\omega t + \theta)]. \quad (10)$$

The general form of equations (9) and (10) is, in terms of analytical geometry,

$$r = k - a\cos(2\phi + \gamma). \quad (11)$$

This is seen to be a modification of the general expression for the cosine term of the second harmonic of the fundamental function. The modification consists of a constant addition to the phase angle and a constant addition to the radius vector. The effect of the latter is to distort the symmetry of the lobes, which are normally equal; the effect of the former is to rotate the resulting major axis of symmetry counter-clockwise. Since this is the second harmonic, the amount of this rotation is half the constant added angle.

This natural division of the Y-intercept of the power curve into two parts, a constant and a variable—equation (11)—suggests a method of constructing the curve independent of the instantaneous values of the emf and current, provided their vectors are given. This will be illustrated for the case in which the current vector lies in the X-axis.

In Fig. 12, let OE and OI be the emf and current vectors respectively, representing effective values.

(1) Draw the line $A'OA$ bisecting the angle θ.

(2) With O as a center describe a circle, CDK, with a radius proportional to $EI\cos\theta$, and another FGH, with a radius proportional to EI.

(3) With $A'OA$ as a diameter, divide FGH into any even number of parts.

(4) To any radius, OL, extended, of CDK, add LP,

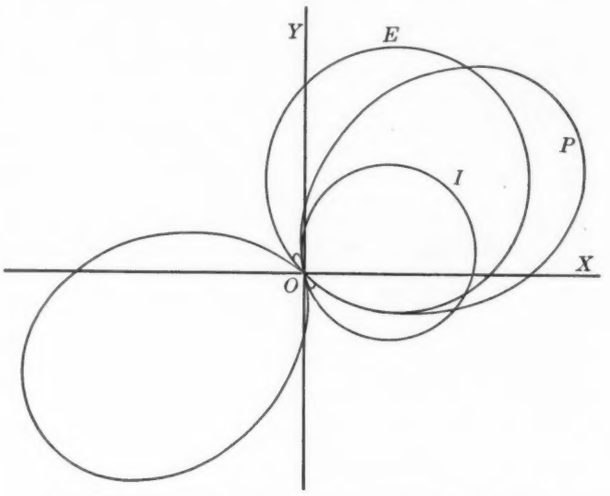


Fig. 10—Polar Curves of Voltage, Current and Power.

equal to ON, the projection upon $A'OA$ of the radius OM of FGH, OM being taken so that $\angle AOM$ is equal to $2(\angle AOL)$.

Then OP represents the instantaneous value of the power at phase $\omega t = LOY$.

Proof:

$$OP = OL + LP \quad (12)$$

$$OL = EI\cos\theta \quad (13)$$

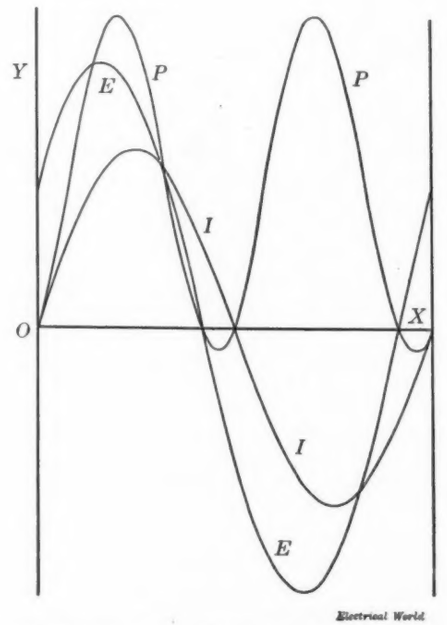


Fig. 11—Rectangular-Coordinate Curves of Voltage, Current and Power.

$$LP = ON = OM\cos AOM = EI\cos 2(\angle AOL) \quad (14)$$

$$\omega t = LOY = \angle XOY - \angle XOA - \angle AOL$$

$$= \frac{\pi}{2} - \frac{\theta}{2} - \angle AOL \quad (15)$$

$$\therefore \angle AOL = \frac{\pi}{2} - \frac{\theta}{2} - \omega t$$

$$2\,(\angle AOL) = \pi - \theta - 2\,\omega\,t = \pi - (2\,\omega\,t + \theta) \qquad (17)$$

$$\therefore LP = EI \cos\,[\pi - (2\,\omega\,t + \theta)]$$

$$= -EI \cos\,(2\,\omega\,t + \theta) \qquad (18)$$

$$\therefore OP = EI\,[\cos\theta - \cos\,(2\,\omega\,t + \theta)] \qquad (19)$$

It is seen at once, from Fig. 12, that the maximum power is always equal to the sum of the radii of the two circles,

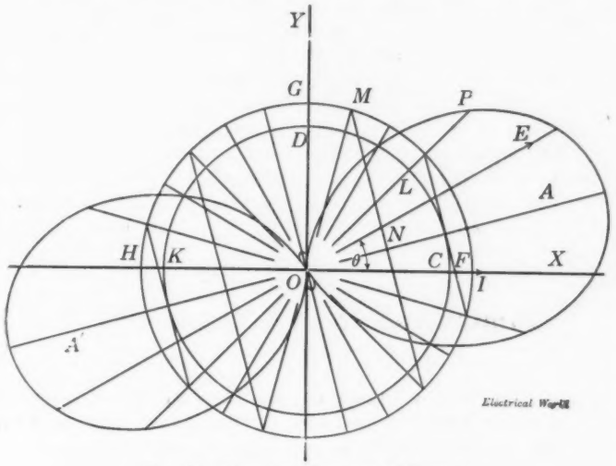


Fig. 12—Circular Diagram of Power.

$EI \cos\theta$ and EI, and that this maximum value is always halfway between the maximum emf and maximum current. The latter is to be expected from the constant addition to the phase angle, which in this particular case becomes θ.

The only integral value of the power wave with which one is concerned is the average value or active power. This is evidently equal to the radius of the circle CDK of Fig. 12, $EI \cos\theta$, and is in no respect a vector quantity. Its magnitude may be scaled off along the X-axis, which is the position of zero phase, as OA in Fig. 13. The apparent power, or product of effective emf and current, is then represented by a line OP, of length EI, making the angle θ with the X-axis, in the first quadrant if the current lags, and in the fourth if it leads. By completing the triangle a figure entirely similar to the impedance triangle is obtained, and one is led at once to the similar triangles for an electric circuit described by Dr. A. E. Kennelly in his paper on "Vector Power" before the American Institute of Electrical Engineers in June, 1910.

Since the line OP has magnitude and direction, with respect to the X-axis, it becomes a vector. It determines the length of OA, and together these two determine the size and shape of the power curve. Therefore OP may be termed the power vector, and, remembering that it is not a geometrical element of the power curve and that the latter's position is dependent upon the position of the emf and current circles, OP may be said to represent the power curve. This vector is fixed and comes within Dr. Kennelly's classification of non-rotative vectors, in contrast with the rotating emf and current vectors.

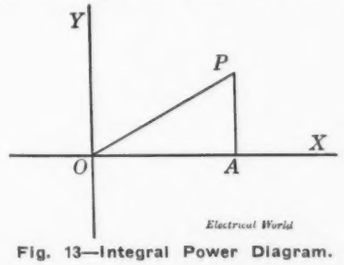


Fig. 13—Integral Power Diagram.

By analysis and development of the "crank diagram" for alternating-current quantities it has been seen that the point at issue in the controversy between direct and inverse representation was fundamentally not a question of direction of rotation but of what should rotate. Two classes of representations have been distinguished: The cycle diagram, showing instantaneous values, and the integral diagram, showing integral values. In the third place, it has been shown how the general form of the "crank diagram" may be extended to include power values. The cycle-power diagram consists of a four-lobed curve, with lobes generally unequal in size. The integral-power diagram consists of a right triangle similar to the impedance triangle.

AUTOMATIC FEEDER REGULATOR.

A paper written by Mr. F. W. Shackelford, of the General Electric Company, for the Pennsylvania Electric Association and in his absence presented at the Bedford Springs convention by Mr. W. P. White, of the same company, on automatic feeder regulation for outdoor service as applied to single-phase lighting circuits, described a small compact device which in outward appearance resembles an ordinary pole-type transformer and is mounted upon the pole in a similar manner. These regulators are designed for 60-cycle, 2300-volt, single-phase circuits and have 10 per cent boost and buck, with current ratings of 10, 15, 20 and 25 amp. Although automatic, the regulator employs no electrical contacts. It is of the induction type, oil-immersed and self-cooled. The operating mechanism is mounted above the oil line and comprises a small single-phase, self-starting motor, which operates continuously. The motor is geared to a crank, which drives a rocker on which are mounted two pawls. The latter are held in a certain position by triggers, but if the voltage varies beyond the prescribed limits, they are adjusted so as to engage with a gear connected to the regulator armature shaft. The potential balance consists of a solenoid having a movable core, which is connected to a pivoted lever at the top and its action regulated by a dash-pot at the bottom. The solenoid lever carries two stop pins, one on each side of the lever pivot. When the voltage is normal the rocker triggers just clear these stop pins, but with a variation of voltage one or other of the points interferes with one or the other of the pawl triggers and the pawl is tripped into mesh with the gear. As the rocker moves forward the pawl engages the gear, and as it returns it carries the gear through a fraction of a revolution. Should the voltage variation be greater than the range of the regulator, an automatic mechanical limit device cuts the operating motor out of circuit. The author maintained that the regulator will satisfactorily hold the voltage within 1.5 per cent of normal and can be relied upon for performance and regulation.

In discussing the paper Mr. Horace Leversidge, of Philadelphia, drew attention to the fact that in modern central-station practice the regulating equipment costs from two to three times as much as the other apparatus for station control, not including the transformer equipment, and suggested that some self-contained regulator, minus automatic adjuncts, somewhat similar to that described would be welcomed if the item of expense could be reduced. Mr. G. F. Wendle, Williamsport, Pa., felt that 1.5 per cent of regulation was hardly close enough, since a small variation in voltage has a very detrimental effect on high-efficiency lamps on lighting circuits, Mr. A. D. Fishel, of the Westinghouse Electrical & Manufacturing Company, said that any regulator which had to be mounted on the pole must, of a necessity, be more or less fool-proof, since the average lineman could not be depended upon to give to delicate apparatus the attention it requires. He stated that it was owing to this reason that the transformer switch for cutting out large transformers and inserting small transformers in the circuit during periods of light load never met with wide use in this country, although the device was meritorious. He held out scant hope for cheaper regulators.

Central Station
Management, Policies and Commercial Methods

GROWTH OF MOTOR-SERVICE BUSINESS AT WORCESTER, MASS.

Exploitation of the market for motor service at Worcester, Mass., resulted in a large increase in the business handled by the Worcester Electric Light Company in 1912, contrasted with the revenue obtained from the same source in 1911. A summary of this business for the two fiscal years is given in the accompanying table. The fiscal year ends June 30.

MOTOR SERVICE BUSINESS, WORCESTER ELECTRIC LIGHT COMPANY.

	1911.	1912.
Total kw-hr. sold for motor service	3,376,246	6,618,605
Number of alternating-current motors	595	899
Number of direct-current motors	420	403
Total number of motors	1015	1302
Connected motor load in hp	5150	8920
Number of motor customers	455	455
Average hp per motor connected	5.06	6.85
Total revenue from motors connected	$106,388	$161,891
Average revenue per kw-hr. from motor service, cents.	3.15	2.44

ELECTRIC COOKING.

At the recent convention of the Colorado Electric Light, Power & Railway Association a paper was presented by Mr. H. F. Holland, Denver, on "Electric Cooking and the Field It Offers to Central Stations." The author said that the electric range is the height of perfection in cooking devices and is an improvement over the gas range, which has been considered the last thing as a perfect appliance. He explained why the electric oven is superior to the gas-range oven on account of the fact that air must be admitted to the gas-range oven, and why baking or roasting in the electric oven insures an absolutely finished product. It is the only range, according to Mr. Holland, that can be installed in a kitchen without flue connections, and it is really as economical from an operating standpoint as is gas. He gave figures with gas at $1.50, $1.25 and $1, and said that in competition with gas sold at these rates electrical energy can be purchased at 3.40 cents, 2.83 cents and 2.27 cents respectively.

He then outlined the kilowatt demand for electric ranges and said that it is reasonable to suppose that the non-coincident use of all ranges at any one time will represent a diversity-factor of 1.25, the non-coincident use of all heating elements a diversity-factor of 1.5, and the non-coincident use of high and low heat one of 1.75. The diversity-factor, therefore, on the entire range load under the above assumption would be 4.5, which means that a generator equipment of only 126 kw would be sufficient to handle a range load amounting to 566 kw, or 150 ranges of 3.775 kw each.

In the discussion of the paper Mr. A. H. Hahn, of the Northern Colorado Power Company, related the experience of his company with the electric range and said that his company recently held a demonstration in its Boulder office at which several hams were roasted in the oven of the range and served to the 1500 ladies attending, the result being that thirty-five ranges were placed on the lines of the company. Regarding the rate charged for energy supplied to electric range users, he stated that a rate of 3 cents per kw-hr. is in effect, but that the company also offers to the consumer another rate with a $1.25 minimum and a 3.5-cent rate for the energy consumed. He also stated that where a farmer has a readiness-to-serve charge for a motor or electric lamp the company does not make another readiness charge for the electric range, but one charge applies to all uses of the energy. One company stated that it had been installing ranges free and also putting them out on trial with satisfactory results. The practice of the Twin Falls (Idaho) Company was cited. At that place the company is making a minimum charge of $2.40 with a rate of 3.5 cents and in addition guaranteeing that the bills for one month will not exceed $4.80.

PRODUCTION COST IN A 6500-KW CENTRAL STATION.

Figures now available from the operation of the Fall River (Mass.) Electric Light Company's generating plant during the year ended June 30, 1912, show a decided increase in economy of operation as compared with the records of 1911. The station is a tidewater plant of 6500-kw rating, containing six 350-hp water-tube boilers, one 4000-kw, one 500-kw and two 2000-kw turbines. The 4000-kw unit was in process of installation in 1911 and was not concerned with the station performance during that year. In 1911 the plant produced 5,764,466 kw-hr. at a manufacturing cost of $51,840, or 0.9 cent per kw-hr., coal costing $3.67 per ton. The fuel consumption averaged 3 lb. per kw-hr. This year the plant generated 7,293,783 kw-hr. at a station cost of $55,359, or 0.76 cent per kw-hr., coal costing the company $3.53 per ton. The payroll of the generating department listed sixteen men in 1911 and eighteen in 1912. The costs given include no fixed charges or administrative expenses, but show the results of station operation in 1912 as follows:

FALL RIVER STATION OPERATING COSTS, 1912.

Fuel (0.47 cent per kw-hr.)	$34,164
Oil and waste	900
Water	1,206
Wages at station (0.19 cent per kw-hr.)	13,687
Repairs of building	1,688
Repairs of steam equipment	1,538
Repairs of electrical equipment	686
Miscellaneous	1,490
Total, excluding fixed costs (0.76 cent per kw-hr.)	$55,359

The station load-factor for the year was 32.5 per cent. During the year the sales of energy for motor service increased from 1,230,960 kw-hr. to 2,055,979 kw-hr.

COMPLAINT OF PROPERTY OWNERS AGAINST POWER HOUSE.

One possibility always to be considered in building electric generating plants in thickly populated or even thinly populated districts is a hostile attitude on the part of adjacent property owners. This is exemplified by the fact that freeholders in the vicinity of the new Northwest station of the Commonwealth Edison Company at Roscoe Street and California Avenue, Chicago, have brought four suits in the Circuit Court of Cook County to restrain the company from further operation of the plant on the ground that it is a nuisance. This action is taken in the face of the fact that the station is built on what was formerly an open waste space; that it has been very carefully designed with all the latest improvements in the art to eliminate smoke and

vibration, and that the company has spent and is spending large sums of money to beautify the surroundings, so that the station and its appurtenances shall be considered not a drawback but an acquisition to the neighborhood. None of these things moves the plaintiffs who have filed their complaints.

ONCE-A-MONTH HEATING-DEVICE CAMPAIGN.

At intervals of about a month the sales department of the Union Electric Light & Power Company, St. Louis, Mo., has been holding bargain-day sales of various electrical heating appliances at half a dozen downtown dealers' and department stores besides its own showrooms. Advertisements in all the daily papers precede the sales, and on the date itself there is a final "To-day Only" reminder, with a list of the places where the reduced prices are in force.

On the July date standard $4.25 electric irons were marked down to $3.19, and the returns of the one-day sale showed 690 to have been disposed of by eight dealers. At the August sale $6.50 toaster stoves were sold for $4.93, 125 stoves being placed. During the months to come similar one-day sales will be held for toasters, percolators, etc., and in November and December there will be special sales of "club" groups of appliances, various combinations of toasters and percolators, irons and stoves, etc., being marked even lower than the individual sale price. This combination-device campaign will come appropriately at a time when Christmas gifts are in demand and will also follow the earlier campaigns by an interval in which the devices already sold will have served as excellent demonstration material to the neighbors of the first purchasers, so that a harvest is to be expected from the holiday follow-up campaign. Mr. F. D. Beardslee is sales manager for the company.

MERCHANTS' SHOW-WINDOW LIGHTING CONTEST.

During a holiday trade carnival at Muncie, Ind., last year local interest in window lighting and decoration was stimulated by the award of cash prizes to the merchants making the best illuminated window displays. The Muncie Electric Light Company contributed to the fortnight's festivities by donating the energy required to operate the 10,000 decorative street lamps temporarily installed, but the window-lighting contest was handled entirely by the merchants themselves, $1,500 in all being collected to defray the expense of installing the street lamps and holding the various carnival contests. Prizes of $25, $15 and $10 were awarded to the three best lighted window displays, the selection of prize winners being made by a committee of the merchants. The Keller-Bryce Company, haberdasher, received first honors. Mr. Feltman, the shoe merchant, who earned third prize in the minds of the lay jury of awards, is an enthusiastic advocate of electric lighting on an extensive scale and declares that electricity is the greatest advertising medium the retail merchant can employ.

Fig. 2—Third-Prize Winner at Show-Window Lighting Contest.

A high standard of illumination prevails in his own windows, each of which is lighted by 1400 watts in tungsten lamps.

STREET-LIGHTING RATES AT MACON, GA.

The City Council of Macon, Ga., has accepted bids for street lighting from the Central Georgia Power Company, subject to ratification by the people at an election to be held in March next. A contract between the city and the company embodying the proposed rates is in preparation. The bids in detail are as follows: Four hundred 4-amp magnetite or metallic flame-arc lamps, operating from dusk to daylight, approximately 4000 hours per year, $21.95 per lamp per year; fifty 50-cp series incandescent lamps, same hours of operation, $8.75 per lamp per year; 100 "white way" posts, each carrying a cluster of five 40-watt tungsten-filament lamps, same hours of operation, $15.90 per post per year; 188 "white way" posts, same as last item, $11.50 per post per year; eleven "white way" posts, each bearing a cluster of two 60-watt tungsten-filament lamps, same hours of operation, $11.90 per post per year.

The Georgia Public Service Corporation filed a competing bid which was considerably higher. For arc lamps the price offered was $32.50 per lamp per year, for incandescent lamps $17.50 per lamp per year, for the first 100 "white way" posts $17 per post per year, for the next 188 "white way" posts $9 per post per year, for the eleven "white way" posts carrying two-lamp clusters $10 per post per year.

Fig. 1—First-Prize Winner at Show-Window Lighting Contest at Muncie, Ind.

The bids accepted from the Central Georgia Power Company will mean a large annual saving to the city in the cost of street lighting. The city is now paying $60 per year for arc lamps. It is reported that this company was influenced in making its low competitive bid by the fact that it has a large investment in street-lighting equipment which would not be available for use in case it failed to secure a renewal of its lighting contracts.

These low rates recall to mind the high rates paid for street-lighting service many years ago. When the first bids were received in 1889 from the Macon Gas Light & Water Company and the old Brush Electric Company the price offered was $144 per arc lamp per annum and $108 per incandescent lamp per annum. The street-lighting appropriation for the first year was $6,500. Appropriations for the present year were $26,308.

MOTION-PICTURE THEATER LOAD IN LOUISVILLE, KY.

The Louisville Lighting Company, Louisville, Ky., has been conducting a special campaign to secure the business of motion-picture theaters. As a result, it has closed contracts with twenty customers of this class and is furnishing electrical energy both for lighting and for motor service for the fans and ventilators. The motion-picture theater managers in Louisville are believers in advertising, and every theater served by the Louisville Lighting Company is prominently featured by an electric sign. The Ideal Theater, at Twenty-sixth and Market Streets, is the company's latest acquisition in this class of business.

COMMERCIAL ELECTRIC-LIGHTING DATA FROM SIX CENTRAL STATIONS.

In the following table is given an analysis of the commercial electric-lighting revenue and kilowatt-hour sales for the fiscal year 1911 in six Massachusetts central stations serving cities ranging in population from about 80,000 to 150,000. The results are compared both in totals and on the unit basis and show decided differences in the use of electric-lighting service even for cities of approximately the same size. At Worcester, Lowell, Brockton, Cambridge and Springfield competing gas companies are in the field, but at Malden the same interests control both gas and electric service. All six plants are operated by private companies.

The table shows that the net revenue derived from commercial electric lighting varied from 5.8 cents to 10.8 cents per kw-hr., and the revenue per capita from $1.32 to $3.44. The United Electric Light Company, of Springfield, had the largest number of commercial lighting customers in proportion to population, about one person in every twenty-five being on the company's books. This company also derived the largest revenue per kilowatt of connected commercial lighting load, or $44. All six companies earned nearly equal amounts in this connection. The revenue per lighting customer varied from $37.40 at Malden to $83.50 at Cambridge, the Malden company occupying mainly residential territory in several northern suburbs of Boston and not being so highly developed as Cambridge from the manufacturing and commercial points of view.

The figures given as to average connected commercial lighting load were derived by averaging the connected load data for the year, and, similarly, the number of customers was obtained by adding the number at the ends of the fiscal years 1910 and 1911 and dividing by two. The figures given as to the ratio of combined average lighting demand at the consumers' installations to the total connected commercial lighting load show the use of the connected load during the year, and, as might be anticipated, the capacity required to handle the average twenty-four-hour lighting load at the consumers' premises was only from about 4 to 8.4 per cent of the total required installation. The revenues shown in the table include earnings from the operation of small motors and heating appliances on domestic and other commercial circuits, but do not include street-lighting operations.

COMMERCIAL LIGHTING REVENUE, SIX CENTRAL STATIONS, 1911.

	Worcester.	Lowell.	Brockton.	Malden.	Cambridge.	Springfield.
Population served	149,223	124,984	83,550	116,753	104,839	104,182
Average number commercial-lighting customers	3,182	2,176	2,249	4,105	2,233	4,346
Average connected commercial-lighting load, kw	6,785	4,257	4,019	4,107	5,018	8,156
Revenue, cents per kw-hr, commercial lighting	8.1	7.7	5.8	10.8	10.6	7.1
Kw-hr. sales, commercial lighting	3,181,793	2,229,825	2,966,773	1,419,483	1,758,685	5,049,405
Total revenue, commercial lighting	$258,821.00	$171,384.00	$172,303.00	$153,057.00	$186,446.00	$357,622.00
Revenue per kw, connected lighting load	38.20	40.00	43.00	37.20	37.10	44.00
Lighting revenue per capita	1.73	1.38	2.06	1.32	1.79	3.44
Lighting revenue per lighting customer	81.00	79.00	77.00	37.40	83.50	82.50
Connected lighting load per capita, watts	45.5	34.3	48.0	34.5	48.0	78.2
Connected lighting load per lighting customer, watts	2120	1963	1790	1000	2260	1875
Maximum net rate per kw-hr, commercial lighting, cents	12	11.7	15	12	12	12
Average load in kw, combined commercial customers' lighting installations	363	254	338	162	200	575
Ratio of above combined average demand to commercial connected lighting load in per cent	5.35	6.0	8.4	3.95	3.98	7.0
Ratio commercial lighting revenue to total earnings from sale of electricity, in per cent	57.0	38.5	52.3	51.7	48.4	60.8
Kw-hr. sales per capita	21.3	17.8	35.2	12.1	16.8	48.0
Kw-hr. sales per customer	1000	1060	1320	1210	790	1164

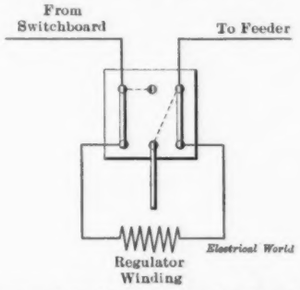
LIGHTING UP THE "FOR RENT" STOREROOM.

A building owner had an empty storeroom for rent. The fixtures and lamps used by the last tenant were still in place, so he turned them on one evening, just to see if his brightly lighted proposition would not look more attractive than the dismal shades pervading the empty storeroom a few doors down the street. People passing the lighted but empty shop looked in, some merely out of curiosity. Several admired the ceilings and cornice. One went off figuring up in his mind how the place would meet his own needs in case he made his intended removal to that part of town. Others kept coming along and looking in, until the night watchman opened the switch. Not one out of a dozen saw or noticed the other empty store in its Stygian darkness, although by daylight it looked like a better-finished room. By the end of the week the owner of the first room accepted the most desirable of several good offers, and the new tenant is now paying good lighting bills. And the dark and empty room is still dark and empty as before.

Wiring and Illumination

DISCONNECT SWITCH FOR FEEDER REGULATORS.

In an Illinois turbine plant having its lighting feeders equipped with induction-type regulators use is made of disconnect switches, like those shown, to cut the regulators clear of their circuits so that they may be repaired or inspected. There are three single-blade hook-type switches

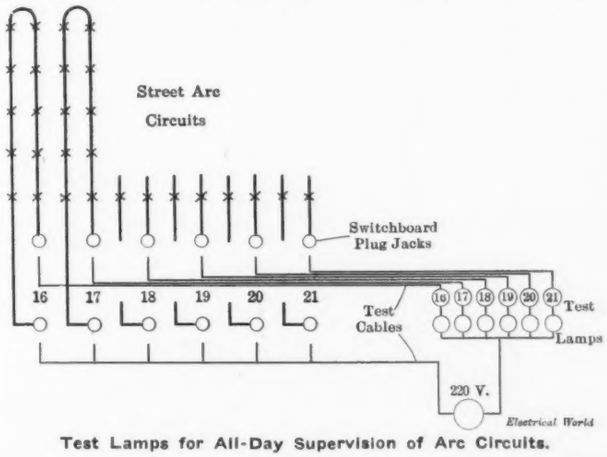


Disconnect Switch for Feeder Regulator.

mounted on a common slate block each over its corresponding regulator. When the two outer blades are closed the regulator winding is in series with the line. To disconnect the regulator, its rotor is first brought back to zero, to avoid short-circuiting any incremental voltage, and the middle blade is then closed. Opening the outer blades finally disconnects the apparatus altogether, rendering it "dead." Meanwhile the feeder may continue in use uninterruptedly.

ALL-DAY SUPERVISION OF ARC CIRCUITS.

When the plug connectors are withdrawn from the switchboard jacks controlling arc-lamp circuits in the St. Louis substations test wires are plugged in in their place, each pair lighting a couple of 4-cp lamps from the 220-volt bus through one of the outside arc-circuit loops. The test wires are formed up to length so that each enters its individual jack and makes connection with the test lamps correspondingly numbered. These test lamps are thus connected up all day, as long as the arc circuits are not in use. If a lamp goes out it is the duty of the station operator to call

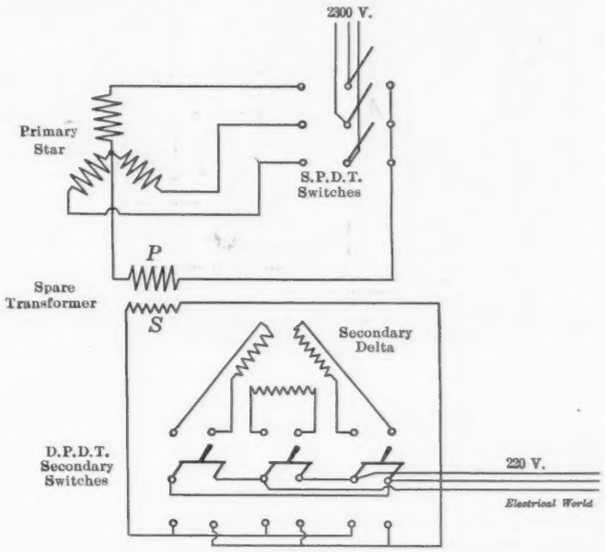


Test Lamps for All-Day Supervision of Arc Circuits.

up the trouble department and notify it of the number of the circuit in trouble in order that repairs can be started without delay. The operator is also required to look at the test lamps once every hour, when he reads his meters, making a note of any circuits open. He must then call the trouble department and report whether or not all test lamps are burning properly. These calls must be made hourly whether trouble is present or not. This system of all-day supervision of air circuits has greatly reduced the number of cases of trouble going undiscovered until nightfall. With the low voltage employed trimmers cannot get a shock of more than 220 volts, or 110 volts to ground, but they are instructed to wear rubber gloves when handling arc lamps on the street.

INSERTING SPARE TRANSFORMER IN STAR-DELTA GROUP.

A fourth spare unit is included in the bank of transformers which furnish energy for the various motors about the new 9000-kw steam-turbine plant of the Laclede Gas Company, St. Louis. The primary windings of these transformers are connected in star and the secondaries in delta. Switching provision has been made by Mr. William Bradford, electrical engineer for the company, so that the spare transformer can be immediately connected in place of any of the other units which may burn out or break down. The scheme used is illustrated in the accompanying sketch. For the star connection three single-pole, double-throw switches



Connections for Inserting Spare Transformer Into Star and Delta Groups.

are required, while for the delta transfer double-pole, double-throw switches are needed. The corresponding primary and secondary switches are mounted in line on the board, so that both windings of the spare unit will be automatically connected to the proper phase. The switch panel for effecting this transfer is mounted directly in front of the transformer bank in the basement.

ELECTRIC LIGHTING OF A PALATIAL ST. LOUIS RESIDENCE.

A number of the electrical fixtures for the $300,000 residence now being completed for Mr. E. A. Faust, St. Louis, are bronze works of art imported from abroad and copied after famous old-world chandeliers and lanterns. The accompanying illustration shows the massive bronze chandelier for the grand entrance hall. This masterpiece measures 5 ft. 5 in. in height and 3 ft. 5 in. in width and was reproduced by Bende, of Mayence, Germany, from the 4-ft. 6-in. original which hangs in the cathedral at Pisa, Italy. The fixture is of Renaissance design and is suspended by a 16-ft. bronze chain from the 40-ft. goldleaf dome. It carries twenty 8-cp candle-bulb lamps and an equal number

of suspended ball-globe lamps and is reported to have cost $1,000. The cornice forming the ceiling of the second-story gallery of this main hall conceals 120 25-watt indirect units, the light from which is projected onto the dome. The central portion of the latter is finished off with art glass, and above this will be hung reflector units to simulate daylight. The approach to the sweeping bronze-and-marble

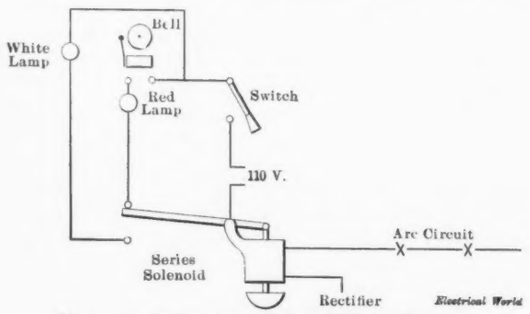
Bronze Chandelier for Grand Entrance of St. Louis Residence.

staircases will also be lighted by pedestal candelabra fixtures now being built in this country. Elaborate gold-bronze chandeliers imported from Germany are also hung in the east living room. For the 30-ft. by 16-ft. dining hall indirect cove lighting has been employed. A cornice conceals the lamps, which project their light onto the arched white ceiling.

In the kitchen electric heating ovens, warmers, iron outlets, dumbwaiters, etc., are provided. Intercommunicating telephones connect all rooms. Switch plates and telephone boxes are, like the hardware, all plated with gold, except those in dark-finished apartments where the color of the metal has been made to conform to the woodwork. For emergency control a number of lamps on the first and second floors are wired with single three-point switches, the master control switch which energizes their "off" positions being placed by the bedside in the owner's room. By a touch of the button the lower floors can be flooded with light, and these "burglar" lamps cannot be extinguished from any other switch than that at which they are turned on. Mr. C. J. Sutter, St. Louis, is the electrical contractor for the Faust residence.

ALARM TO INDICATE OPERATION OF REMOTE RECTIFIER SET.

Two of the seventy-five lamp, 4-amp magnetite-arc rectifier sets in the Vandevanter substation of the Union Electric Light & Power Company, St. Louis, had to be mounted in the basement on account of lack of space on the main operating floor. Since the station operator could not make sure that the rectifiers were working properly without running up and down stairs at intervals, Mr. W. A. Yandell, in charge of substations, arranged the series-solenoid alarm circuit illustrated. As long as the rectifier operates properly the white lamp is lighted. If the arc circuit is interrupted the contact arm drops to the bell circuit, at the same time lighting a red lamp as a visual warning. At the St.



Alarm for Operation of Remote Rectifier Set.

Charles Street substation, where a number of rectifiers are banked together closely, the series solenoids of the tube circuits are arranged to ring an alarm bell in case of any interruption. If an arc forms between the auxiliary electrode of the tube, short-circuiting and causing danger of overheating of the exciting transformer, the alarm is similarly sounded.

INDIRECT EFFECT IN ARCHITECTURAL ILLUMINATION.

The splendid white Corinthian façade of Temple Israel, King's Highway, St. Louis, is lighted by tungsten lamps concealed in the classical brazier ornaments which flank the steps of the approach. Graceful tripods carry the brazier bowls at a height of 8 ft. above the pedestal blocks, which are in turn 6 ft. above the sidewalk, so that the lamps

Indirect Fixture Lighting Façade of Temple Israel.

are well beyond the level of the eye. Protecting the open tops of the bowls from the weather are heavy 24-in. glass domes, which inclose the lamps. Each brazier contains four 100-watt units, the light from which is projected upward onto the noble façade of the temple, bringing it into gentle relief after dark.

In this artistic concealment of practical lighting units

seems to lie a suggestion for enlarging the architectural and artistic value of many handsome public or semi-public structures whose lines of beauty are now shrouded in darkness during evening hours when, perhaps, most human eyes would be ready to enjoy them. The application of indirect lighting to the front of the St. Louis temple is most dignified and appropriate, and the ancient bowls seem well fitted to contain, at least, their measure of the fire of heaven whose fateful fury they formerly supplicated.

ORNAMENTAL CURB POSTS FOR HEARST BUILDING, CHICAGO.

The six handsome five-lamp curb posts installed in front of the new Hearst Building, Chicago, are of a unique and beautiful pattern built after special designs made by Mr. Albert Fournier, a Chicago sculptor, for the Commonwealth Edison Company. "Neo-grec," a combination of classic Greek with art-nouveau principles, supplies the graceful outlines and ornamental surface detail of the standards. Each post carries four downward lamps and one upturned center lamp, each inclosed in a 14-in. milk-glass ball globe. The new Hearst building is of elaborately ornamented rococo design with varicolored tiles, and it was the desire to employ lighting fixtures which would conform to the ornamentation of the building itself. The posts used, one of which is illustrated herewith, measure 14 ft. from the sidewalk to the center of the lower lamp globes and 16 ft. 10 in. to the topmost lamp. The arms have a maximum spread of 40 in. and are set at right angles with the curb line, showing at least three of the lower lamps when viewed from any position on the sidewalk. The four arms and main standards of each post were all cast separately, and the entire fixture complete weighs about 1600 lb. The posts were furnished by the Dearborn Foundry Company, Chicago.

"Neo-grec" Lighting Posts at Hearst Building, Chicago.

INDIRECT LIGHTING OF A BANKING ROOM FROM THE CASHIERS' CAGE GRILLE.

The room occupied by the savings department of the Union Trust Company in the Tribune Building, Chicago, has been equipped with indirect lighting from tungsten lamps in reflectors concealed in the cornice of the cashiers' cage grille. The light thus diffused by the dull-finished ceiling suffices for the illumination of the tellers' cages, bookkeepers' desks, etc., without the use of local desk lamps of any kind. From the bank grille proper an open partition, made up of corresponding mahogany columns carrying the lighting cornice, has been extended back through the depositors' reception room and around to join another cage grille, making altogether nearly 150 ft. of reflector trough near the center of the room and available for supporting the concealed tungsten units.

As shown in the accompanying plan of the room, care was taken in planning the location of the 25-watt lamps to space them so as to conform to the varying lighting requirements of the interior, the units being placed closer together in the darker portions of the room.

A total of 173 25-watt lamps make up the lighting equipment of the room, each lamp being inclosed in a National X-ray E-40 reflector. The ceiling is 12 ft. high and the reflector trough is 7 ft. 6 in. above the floor. In area the main banking room measures roughly 74 ft. by 38 ft., and the lighting was designed to give an average intensity of 4 ft.-candles over the entire space. In the working area behind the grille the intensity probably rises to 4.25 ft.-candles, while outside, in the public space, 3.75 ft.-candles proves sufficient. The flat skylight at the rear of the room is of diffusing translucent glass with an absorptive loss coefficient of about 27 per cent. Above this skylight are twelve beehive reflector units which take the place of natural illumination when the sun fails to find its way in between the buildings. For purposes of control the reflector lamps in the trough are divided into groups of five and six each, individually manipulated from thirty double-pole knife switches in a steel panel box mounted in one of the columns. By means of these switches any group of lamps may be lighted or extinguished independently of the others, so that parts of the room can be illuminated while the remainder is in darkness. Indeed, with this refinement of control a single accountant working overtime in the evening need turn on only the group of lamps nearest him, securing all necessary illumination and saving the energy required to light the entire installation.

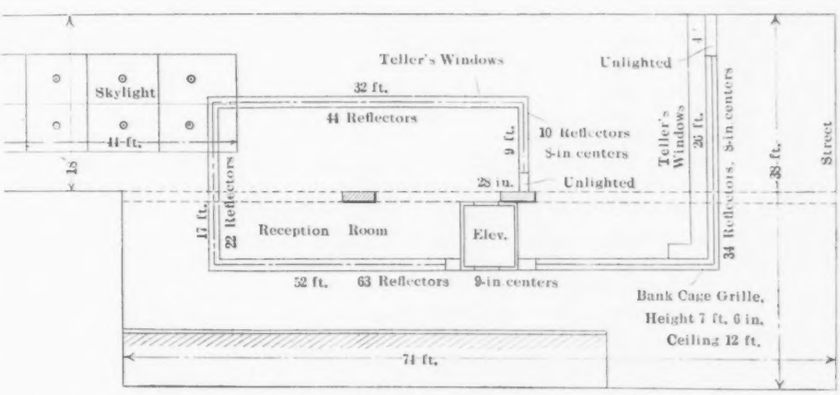


Fig. 1—Indirect Lighting of a Banking Room from the Cashier's Cage Grille.

The general effect produced by this grille-cage illumination is very attractive and restful. All light sources are concealed from direct view and no fixtures are in sight to mar the unobstructed ceiling. The tellers and clerks declare that they are able to work in entire comfort with the illumi-

nation afforded by the indirect fixtures alone, no desk lamps or other direct illuminants being used. The grille structure itself is of dark mahogany with a base of black-and-green marble. Graceful ionic columns are employed to support the cornice, while the customary brass caging makes up the panels. In the pergola extensions of the trough lighting behind the cages proper the same type of columns is

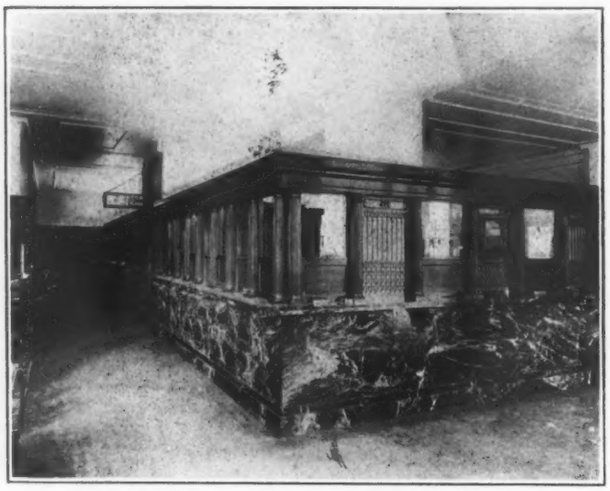


Fig. 2—Indirect Lighting from Cashier's Cage.

used to carry the overhead cornice. Marshall & Fox, architects, designed the fixtures for the banking room, the lighting features of which were laid out by the engineering department of the National X-Ray Reflector Company, Chicago.

RECENT TELEPHONE PATENTS.

MAGNETO CORD CIRCUITS.

It has long been found desirable to employ electrically locked and restored drops for certain conditions of service. It is with such a type of drop that the patent lately granted to Mr. R. H. Manson, of Elyria, Ohio, is concerned. He employs two relays, mounted as a single unit, the coils lying side by side. One of these operates a trip mechanism, which permits the armature to fall and close a back contact, thereby exhibiting the signal. The armature of the second relay serves to restore and latch the shutter. The advantage of this arrangement lies in confining all the working parts to one side of the mounting plate, the terminals being confined to the opposite side. This patent is assigned to the Dean Electric Company.

When at the close of a message it is desired to signal the operator the distant station should not be disturbed; but in magneto systems this often cannot be accomplished. To overcome this difficulty Mr. E. H. Colpitts, of East Orange, N. J., has devised a magneto circuit in which the connecting cords are divided by a repeating coil. This coil has two pairs of windings, the inside terminals of both pairs being connected to condensers. The outer ends are connected to the respective cord strands. The clearing-out drop is double-wound, each winding being associated with one end of the cord pair and bridged around the corresponding condenser. The success of the system depends upon connecting the drop so that the secondary induced potential is equal and opposite to the induced potential in the corresponding winding of the repeating coil. Thus, if a signal arrives from either direction it will actuate the drop, and at the same time the secondary side of the drop and the secondary of the repeating coil will short-circuit each other, owing to the method of connection, and no current will flow out on the other line. The Western Electric Company has obtained this patent by assignment.

Letter to the Editors

RADIANT EFFICIENCIES.

To the Editors of the Electrical World:

Sirs:—The article by Messrs. Damon and Enders on "Radiant Efficiency of the Carbon Arc Lamp" in your issue dated Sept. 7, while interesting and valuable, is nevertheless open to criticism for its treatment of the definition of luminous efficiency. The authors, in common with many physicists who have attacked the problem of luminous efficiency, appear to be content with determining the ratio of a certain portion of the radiation (from 0.0 μ to 0.76 μ) called, largely by courtesy, "luminous" to the total radiation. This definition of luminous efficiency, they remark, is a "purely physiological one." On the contrary, it is almost a purely physical one. A purely physiological one not only takes into account the fact that the radiation can be seen but weighs the radiation by its light-producing value.

In the matter of luminous efficiency physicists are still following Prof. Langley, the pioneer in this work, who as the first in the field desired some rough measure of light value. I venture to say that Langley—who was also a pioneer in determining the luminosity curve of the eye—if alive to-day, would quickly abandon the largely arbitrary and crude division into luminous and non-luminous radiation.

The defect of the purely physical division is that it takes no account of the relative luminous efficiencies of the visible radiations of the sources measured. The 100 per cent efficiency is not fixed, but differs for each light source. The 100 per cent of a Hefner lamp, for instance, is very much less efficient than is the 100 per cent of a carbon arc lamp, owing to the more advantageous distribution of energy for the purpose of light production in the visible spectrum of the latter. Drude, in his "Lehrbuch der Optik," one of the most trustworthy of modern textbooks on optics, falls into an error for this very reason. Taking an experimental value for the mechanical equivalent of the visible radiation of the Hefner lamp, he assumes the same value for the visible radiation of a carbon arc lamp and then, from the watts per candle of the latter, calculates the "luminous efficiency." Since the true luminous efficiency of the visible radiation of the arc is about 50 per cent greater than that of the Hefner, an error of that amount figures in the result.

The significant thing to note is that the numerical values given for the carbon arc in the paper referred to are not on the same scale but on a different scale for each value given, and that these values are at best only a rough indication of true specific output in lumens per watt. There is another multiplying factor, namely the "how-useful" factor, to be applied to these values of useful radiation. The over-refinement of working out such values to four significant figures is obvious. Our interest is in knowing not what proportion of the energy would be sufficient to give the same quality of light in each individual case considered *per se*, but what relative energy is consumed to give the same quantity of light from the different sources.

A true measure of radiant luminous efficiency—exactly proportional to lumens per watt—is obtainable by substituting for the opaque screen used by Mendenhall, Forsythe and Messrs. Damon and Enders a screen the transmission of which is proportional at each wave-length to the luminosity curve of the average eye, with a maximum transmission of unity.

It is worthy of note in passing that such a screen can be very closely approximated by colored absorbing media, whereby the elaborate spectroscopic apparatus necessary to secure a sharp spectral cut-off may be dispensed with.

Reference may be made in this connection to a paper on "Luminous Efficiency" in the *Transactions* of the Illuminating Engineering Society, February, 1910.

Philadelphia, Pa. Herbert E. Ives.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Voltage Variation of Direct-Current Shunt Machines.—M. OSNOS.—Voltage regulation of self-exciting direct-current shunt machines by means of ordinary resistances is possible only within very narrow limits. The reason is that so far the voltage has been regulated by the uniform change of the mean flux in the whole machine and the mean flux cannot be reduced below a certain limit. The author describes a new method in which the total flux in the machine is varied to regulate the voltage, but in one part of it the value of the mean flux is maintained constant to provide stability. Experiments were made with a 250-r.p.m., 10.8-kw, 110-volt, eight-pole machine and an ordinary rheostat was connected in a shunt with six of the eight pole coils of the machine. Fig. 1.) In series with the resistor and the six pole coils were the other two pole coils of the machine. In this way the current in the six coils can be reduced at will by means of the resistor while the current in the other two coils is not reduced but even somewhat strengthened. In this way the voltage can be regulated between 136 volts and 38 volts. This was possible with the unloaded as well as the loaded machine without any sparks occurring on the commutator. The curves for no load are given in Fig. 1. For the sake of symmetry two diametrically opposite pole coils were chosen as those in which the current was not reduced. The author shows how to pre-determine the no-load characteristic curves and gives the results of tests confirming the theory.—*Elek. u. Masch.* (Vienna), Sept. 8, 1912.

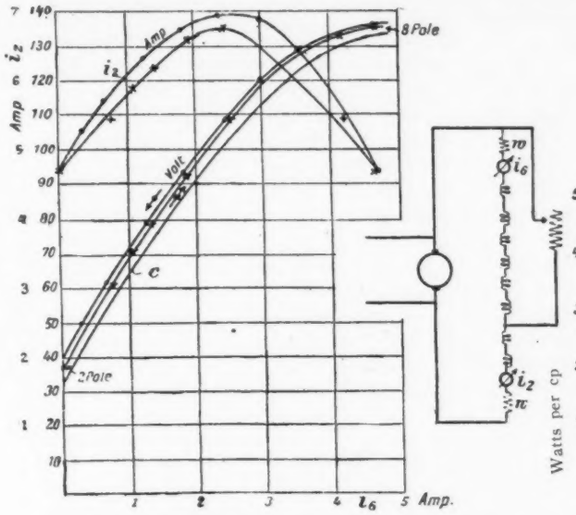


Fig. 1—Voltage Variation of Direct-Current Shunt Machines.

Braking of Alternating-Current Commutator Machines.—F. NIETHAMMER AND E. SIEGEL.—The conclusion of their illustrated article on methods of braking alternating-current commutator motors having a series characteristic in such a way as to return energy into the network. Under normal conditions this is impossible because self-excited currents are produced, but if proper precautions are taken these self-excited currents can be held back. With a series motor with a cross-coil, braking with recuperation of energy becomes possible by the aid of an intermediate transformer with high magnetic reluctance. If the proportions are properly chosen, the self-excited currents may be completely suppressed even when the braking resistance is short-circuited. With repulsion motors of all types braking with recuperation of energy becames possible by using large values for the cross flux, and especially high magnetic reluctance for the cross flux (by providing an increased air cap). With all these motors the efficiency of braking can be further increased by suitable connections of the braking resistance, for instance, connection with choking coils. The possibility of braking with recuperation of energy at any speed is a particular property of alternating-current commutator motors with series characteristic, which makes them superior to all other types with respect to braking.—*Elek. u. Masch.* (Vienna), Sept. 8, 1912.

Lamps and Lighting.

New Metallic Vapor Lamp with White Light.—M. WOLFKE.—An account of an investigation in which the author jointly with C. Ritzmann developed a new metallic-vapor lamp which gives a light similar to daylight. The metals which can be used for this purpose must have a low evaporation temperature and must not react chemically with quartz. Only zinc and cadmium fulfil these conditions in every respect. Experiments with zinc did not give good results. Further experiments were, therefore, made with cadmium. Cadmium alone gives a light in which the red predominates, but if from 3 to 10 per cent of mercury is added to the cadmium the light is practically of daylight quality. Fig. 2 gives the specific consumption in watts per cp as a function of the total watts consumed. Curve I relates to a lamp in which the cathode was of alloy of cadmium with mercury, while the anode was of graphite. Curve II relates to a lamp in which both cathode and anode were made of the cadmium amalgam. It will be seen that the lamp in which both electrodes are made of the amalgam is considerably more economical. The specific consumption tends to reach a minimum of 0.16 watt per cp. The relation between voltage and current is given in Fig. 3. Curves I and II relate to cadmium amalgam lamps, as just mentioned. Curves *a* and *b* relate to the mercury-vapor lamps of Kuech and Retschinsky and of Cooper Hewitt respectively. Different methods of starting the lamp are described.—*Elek. Zeit.*, Sept. 5, 1912.

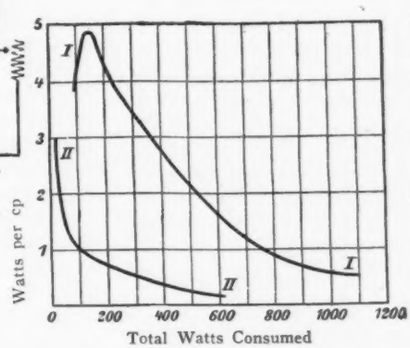


Fig. 2—Specific Consumption of Metallic Vapor Lamp.

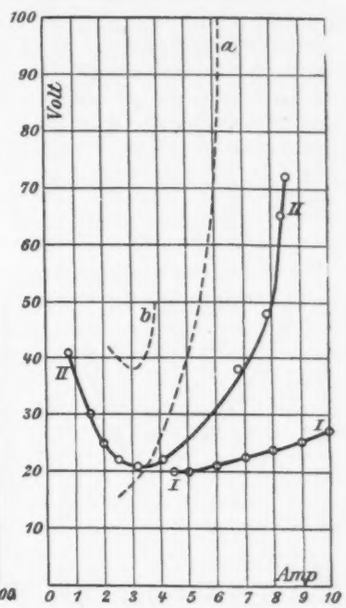


Fig. 3—Relation Between Voltage and Current in New Metallic Vapor Lamp.

Photometry of Lights of Different Colors.—H. E. IVES.—

A second paper of his serial. In the present paper the author deals with spectral luminosity curves by the method of critical frequency. Spectral luminosity curves obtained by the method of critical frequency show a reversed Purkinje effect, but at very low illuminations a true Purkinje effect, the latter observed by Haycraft. A plot of critical frequencies against the logarithm of the illumination for white light gives, as found by Porter, two straight lines of different slope, which meet at about 2.5 I. U. The reversed Purkinje effect occurs above this point, the true Purkinje effect below it. When separate colors are investigated and plotted in the above manner, a set of straight lines of differing slope results. At about 2.5 I. U. these lines in general change their slope, but while the line for deep red does not change, that for blue becomes horizontal, or critical frequency becomes independent of illumination. The Purkinje effect and its opposite follow at once from these facts. The flicker photometer is shown to be largely influenced by the critical frequency phenomena, but not to obey the simple law which would follow were it a mere dovetailing of two pure flickers. The peripheral retina is found to be more sensitive to flicker only for momentary observation before adaptation or fatigue sets in. The fovea is more sensitive to red flicker, the periphery to blue, and the difference is more striking at low illuminations, as noticed by Dow. The phenomena of critical frequency are in general accord with Koenig's theory of the function of the visual purple and with the hypothesis that the retinal cones are chiefly active in the case of intermittent or alternating stimuli.—*Phil. Mag.*, September, 1912.

Generation, Transmission and Distribution.

Equalization of Load Fluctuations.—A. Schwaiger.—The conclusion of his long illustrated paper on the equalization of the rapid load fluctuations in power plants by means of storage batteries or flywheels so as to cause the generators and prime movers to be operated with a constant mean load. The equalizing effect is usually artificially increased by means of balanced or non-balanced regulating machines or regulating mechanisms. The operation of the balanced systems is more accurate than that of the non-balanced systems, but with the former there is occasionally a tendency to oscillations, and this is more serious with regulating mechanisms than with regulating machines. The operation of non-balanced systems is stable under all circumstances. If flywheels are used for equalizing the load, it is preferable to use only balanced systems. Storage batteries are preferable when the load fluctuations are irregular and do not occur so often but are of a longer duration. Storage batteries should be discharged in general with current not higher than their normal one-hour discharge current. If the load curve shows very high peaks in comparison with the mean load, the batteries become expensive and are not utilized fully. On the other hand, flywheels can give almost instantly any amount of energy. They are therefore especially suitable when the load curve has high peaks. The author concludes that the storage battery is particularly suitable for slow and moderate and long-lasting discharges and charges, while the flywheel is suitable for short excess loads of any amount of intensity. For operations with a rapidly varying load and high peaks combined battery and flywheel system is the most suitable to use.—*Elek. Zeit.*, Sept. 5, 1912.

Traction.

Monorail Traction.—B. L. Newkirk.—The author points out that the Brennan apparatus for the stabilization of the monorail car is subject to the phenomena of nutation, as are all rotating bodies. So far little attention has been paid to this part of the theory. The author investigates the magnitude which nutational vibrations may reach and finds that the amplitudes of nutational vibration are small and the period is short, and that all harmful effects could be prevented by taking care in the design of the car and stabilizing apparatus.—*Journal Franklin Inst.*, September, 1912.

Electro-Pneumatic Braking.—W. V. Turner and P. H. Donovan.—The first parts of a very long illustrated serial on the use of the electro-pneumatic brake system for steam road service.—*Journal Franklin Inst.*, August and September, 1912.

Installations, Systems and Appliances.

Electricity Supply to Madrid.—H. Bindemann.—The author discusses the promotion of electrical companies during the last ten years in the city of Madrid, Spain. They include a producer gas plant, four hydroelectric transmission plants and one new distribution company aside from the ten which already existed. The competition which resulted has caused the larger plants to form groups and to absorb the smaller ones and has caused a reduction of the original rates for electrical energy by 75 per cent. It is to be expected that within a short time the two remaining main groups will combine to form a trust and increase the tariff again, as at present the business does not pay.—*Elek. Zeit.*, Sept. 5, 1912.

Lessening the Effect of Sudden Current Rushes.—A note on a recent British patent (No. 22,624, Aug. 29, 1912) of P. V. Hunter and W. L. Shand. Instead of connecting large generators to the busbar through impedance coils to lessen the effect of sudden current rushes, use is made of transformers in the secondary circuits of which are placed resistors with a positive temperature resistance coefficient, for example, metallic-filament lamps.—London *Elec. Eng'ing*, Sept. 5, 1912.

Automatic Motor Starter.—A note on a recent British patent (No. 18,611, Aug. 29, 1912) of M. B. Field. The starter may be controlled from a distance and is arranged when once started to cut out resistance at a definite rate, but it returns to the off position in abnormal circumstances and under the usual overload and no-voltage conditions. A pendulum, when started swinging, makes an electrical contact at each beat, and thus moves a ratchet wheel one tooth forward and cuts out one step of resistance electromagnetically. A further pawl mechanism provides against backward rotation. An auxiliary ratchet and pawl mechanism carrying a cam breaks the electrical circuit of the main ratchet mechanism after such time as the starter should have completed its motion. In a modification use is made of two pendulums with slightly different periods, one controlling the forward and the other the backward pawl. They are started out of phase and are adjusted to be just in phase when the starter should be at the full position, when both pawls are withdrawn, so that the starter is either held on by the hold-on coil or else flies back to the off position.—London *Elec. Eng'ing*, Sept. 5, 1912.

Wires, Wiring and Conduits.

Conduits.—J. Schmidt.—The first part of an illustrated description of various new systems of cable conduits. In the present instalment conduits made of clay, cement and concrete are discussed.—*Elek. Zeit.*, Sept. 5, 1912.

Electrophysics and Magnetism.

Caloric Theory.—H. L. Callendar.—His presidential address to Section A of the British Association for the Advancement of Science. The object is to consider "some of our fundamental ideas with regard to the nature of heat, and in particular to suggest that we might with advantage import into our modern theory some of the ideas of the old caloric or material theory which has for so long a time been forgotten and discredited." Its relation to the kinetic theory is sketched. "We may at least assert with some degree of plausibility that material bodies under ordinary conditions probably contain a number of discrete, physical entities, similar in kind to X-rays or neutral corpuscles, which are capable of acting as carriers of energy and of preserving the statistical equilibrium between matter and radiation at any temperature in virtue of their interchanges with electrons. If we go a step further and identify these corpuscles with the molecules of caloric, we shall certainly come in

conflict with some of the fundamental dogmas of the kinetic theory, which tries to express everything in terms of energy, but the change involved is mainly one of standpoint or expression. The experimental facts remain the same, but we describe them differently. Caloric has a physical existence, instead of being merely the logarithm of the probability of a complexion. In common with many experimentalists, I cannot help feeling that we have everything to gain by attaching a material conception to a quantity of caloric as the natural measure of a quantity of heat as opposed to a quantity of heat energy."—London *Electrician*, Sept. 6, 1912.

Electrochemistry and Batteries.

Heat Losses in Electric Furnaces.—F. A. J. FITZGERALD.—A paper emphasizing that in the design of an electric furnace one of the first things to be considered in avoiding heat losses is to make the rate of generation of energy per unit volume of charge as high as is compatible with other considerations, for in this way the saving of heat losses may be largely prevented. Another point of great importance in furnace design in order to avoid heat losses is to keep the external surface of the furnace as small as possible. Further experiments were made with different materials to study their behavior as heat insulators. Red building brick and "insulating building brick" are better heat insulators than either firebrick or silica brick or manganese brick. By far the best heat insulator is, however, kieselguhr brick. Further, the heat loss from a furnace constructed of firebrick could be reduced to less than one-half by providing the fire-brick walls with a special asbestos jacket.—*Met. and Chem. Eng'ing*, Sept. 12, 1912.

Electric Steel Refining.—A paper by R. Amberg on the function of the slag in the different steps of electric steel refining; a paper by P. Héroult on recent progress made in electric steel refining, especially for rail steel, and a paper by A. E. Greene on electric heating and the removal of phosphorus from iron.—*Met. and Chem. Eng'ing*, Sept. 12, 1912.

Phosphate Fertilizers.—W. PALMAER.—A paper describing a new method which is in commercial operation for producing bicalcic phosphate fertilizers with the help of electrolytically produced acid and alkali.—*Met. and Chem. Eng'ing*, Sept. 12, 1912.

Units, Measurements and Instruments.

Mercury-Break Converter.—P. R. COURSEY.—An illustrated description of a mercury-break converter which is specially useful for small-power wireless installations, for short-distance transmission and for experimental purposes, where a direct-current supply is available, in cases where the expense of installing a motor-alternator set is not warranted. The apparatus consists of a motor-driven mercury jet break, or interrupter, which when combined with a condenser converts straight from the direct-current supply to alternating current at from 10,000 to 50,000 cycles per second, and this can then be transformed up to a voltage suitable for use with a spark-gap transmitter by means of an air-core transformer, thereby avoiding all iron losses and rendering the apparatus very much smaller and less costly to construct for a given power output. The mercury break was constructed as follows: A piece of steel rod, *A* (Fig. 4)was turned to the shape shown, and was drilled with two holes, *BC* and *DE* in the figure, which terminate at their upper ends, *C* and *E*, in two jet holes perpendicular to the axis of the rod and about 3/16 in. in diameter. This rod forms the mercury pump, and when mounted between bearings *F* and *G*—the lower end dipping into mercury contained in the glass jar *H*—and driven by a motor, it pumps mercury up through the holes *BC* and *DE* by centrifugal action and causes the revolving jets of mercury from *C* and *E* to impinge on the ring of contacts *KK*, of which there are eight, equally spaced round the circle. *N* is a small vane to prevent the whole mass of mercury being carried round by the rotation of the pump. The complete pump is mounted in the glass jar in the manner shown, all the parts being fixed to the upper (insulating) cover *P*, which is bolted down to the base with four steel rods. The usual level of the mercury is shown at *OO*. Tubes are also pro-

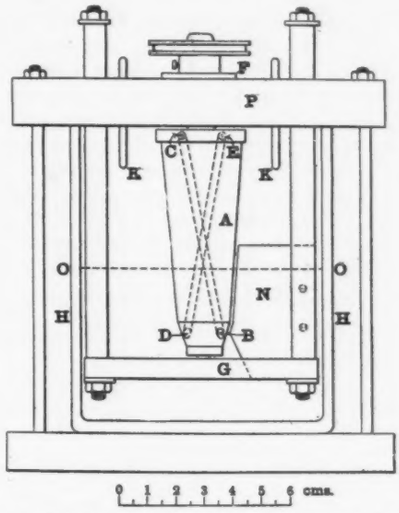


Fig. 4—General Arrangement of Mercury Break.

vided in the cover for leading coal gas through the jar when the break is in operation, so as to prevent oxidation of the mercury. This break is belt-driven from a small direct-current shunt motor at speeds which can be varied from about 1000 to over 4000 r.p.m. Two different methods of connections are possible, one being called the charge and discharge connection and the other the discharge connection. The latter, which is the more effective, is shown in Fig. 5, in which the condenser is permanently connected to charge across the supply voltage, and the break *B* periodically discharges it through the primary L_3. The secondary L_4 feeds the condenser C_2, forming part of the high-frequency transmitting oscillatory circuit C_2L_3; and hence for best effects the circuit C_2L_4 should be resonated with the circuit C_1L_3—that is, $C_2L_4 = C_1L_3$, from which L_4, the secondary inductance, can be determined, the value of C_2 being fixed by the wave-length of signals that it is desired

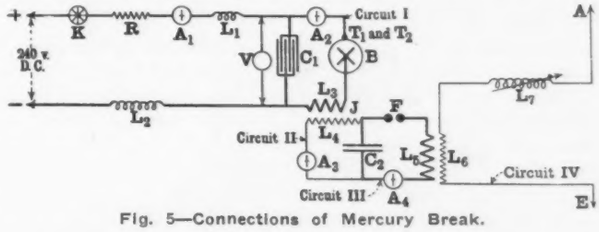


Fig. 5—Connections of Mercury Break.

to transmit. The remainder of the circuit is the same as that usually employed for spark transmitters. The results of some tests are given.—London *Electrician*, Sept. 6, 1912.

Quadrant Electrometer.—W. F. G. SWANN.—Very small currents are frequently measured by observing the rate of movement of the needle of a quadrant electrometer as the electricity enters one of the quadrants. Such currents are, of course, often measured by connecting the quadrant to earth through a very high resistance and noting the steady deflection which is produced when the electricity passes into the quadrant at the same rate as it leaves through the high resistance. The former method is more sensitive, however, and is very convenient in practice, but even though the electricity passes into the quadrant at a uniform rate, the needle does not move with uniform velocity, owing to the inertia. If this fact is not taken into account it may cause considerable errors. The author gives the exact theory for two special cases. In the first case the difference

of potential driving the electricity into the quadrant is large compared with the rise of potential of the quadrant during the observations. The second case considered is the one in which the alteration of the current due to the rise of potential of the electrometer is of importance.—*Phil. Mag.*, September, 1912.

Frequency Indicator.—A note on a recent British patent (No. 7658, Aug. 29, 1912) of W. P. Thompson (communicated from Gesellschaft für Drahtlose Telegraphie). To measure any frequency, and at the same time to be independent of the amplitude of the current, an instrument like a torsion balance with no external control is used. Two conductors with different impedances rigidly connected are placed in a magnetic field produced by the current the frequency of which is to be measured. The position at which they come to rest determines the frequency.—London *Elec. Eng'ing*, Sept. 5, 1912.

Telegraphy, Telephony and Signals.

Electrolytic Condenser for Sparkless Contacts.—Karl Siegl.—A sparkless contact for electric clocks, etc., is obtained either by a shunt which makes the contact device complicated or by a condenser in series which simplifies greatly the construction. Since a well-insulating condenser of high capacity is expensive, the author has looked for a cheaper substitute and has found that the electrolytic condenser consisting of iron electrodes in caustic potash solution is very suitable. A number of such cells connected in series represent an electric valve which permits passage of the commutated current only for a very short time. The time of passage depends, on the one hand, on the ratio of the capacity of the valve cells to the resistance of the cells and on the external circuit, and, on the other hand, on the ratio of the number of cells to the voltage of the supply circuit. By properly proportioning these elements it is possible to reduce the time of passage of the current to a very short interval, so that the electrolytic condenser in an electric clock system insures accuracy to a high degree.—*Elek. Zeit.*, Aug. 29, 1912.

Submarine Telegraph Cable.—H. W. Malcolm.—In the continuation of his long serial on the theory of the submarine telegraph cable application of the formulas is made to a leak with double block and to a continuously distributed leakance. One of the conclusions of the author is that the insulation resistance of the submarine telegraph cable is 10,000 times greater than it need be.—London *Electrician*, Aug. 30, 1912.

Transmission of Pictures.—A. Marino.—An illustrated description of the principles of the Marino system of transmitting photographs and pictures. Selenium cells are used, a special method being employed to eliminate the effects of their inertia.—*La Lumière Elec.*, Aug. 31, 1912.

Miscellaneous.

Amount of Energy Required for Electro-Culture.—A note on exact measurements of the amount of energy used in electro-culture which have been made by M. Breslauer. In his experiments, which were carried on in conjunction with the German Society of Agriculture, near Potsdam, 60,000 sq. m. were covered with a network consisting of tinned steel wires 0.8 mm in diameter, suspended from 4 m to 5 m above ground at a distance of 10 m from each other. This wire net was charged positively, while the negative pole of the current source was connected to the ground. The measuring arrangement consisted of a very sensitive moving-coil ammeter inserted in the earth connection. The tension could be measured only by the aid of a spark-gap in free air, which, as is well known, corresponds to a tension of about 3000 volts per millimeter with spheres 25 mm in diameter. In dry, not too hot, weather the instrument showed a deflection of sixty-one scale divisions with the entire net in circuit and forty-one scale divisions with half the net in circuit, each scale division representing 0.00076 amp. Taking into consideration a shunt, which reduced the sensitiveness of the instrument to about one-tenth, the current employed for one-half of the net was 0.385 milliampere, for the entire net 0.51 milliampere. The spark-length varies between 20 mm and 25 mm, and the average tension, therefore, was 65,000 volts. The fact that the currents are not as 1 to 2 shows that strong radiations probably take place in the neighborhood of the apparatus and from the conductor leading to the net. Twice the difference between the two measurements, namely, 0.26 milliampere, must therefore be considered as the energy actually radiated by the net for the entire 60,000 sq. m. Thus the power was 17 watts, 0.00028 watt per square meter. According to the meteorological observations made near Potsdam during 1908, the current intensity thus artificially produced is from 1000 to 10,000 times as large as that furnished by nature and should, therefore, be sufficient to produce perceptible effects, if any influence on the vegetation is exerted at all.—London *Electrician*, Sept. 6, 1912.

Rubber.—A. Troller.—An article on the synthesis of rubber. After giving notes on the chemical compositon of India rubber the author discusses the polymerization of isoprene and economical sources of supply of isoprene.—*La Lumière Elec.*, Sept. 7, 1912.

Book Review

Concentration and Control. By Charles R. Van Hise. New York: The Macmillan Company. 281 pages. Price, $2 net.

In the present conflict of minds as to what the trust problem is and how it should be met, Professor Van Hise's sub-title—"A Solution of the Trust Problem in the United States"—has an ambitious sound. However, it will be observed that this is *a* solution, not necessarily *the* solution. The first chapters present a useful and succinct review of industrial concentration as exemplified by its most conspicuous examples. This review is up to date and is characterized by skilful marshaling of facts and figures, as well as by illuminating comment. The other chapters contain a brief review of the trust problem and tell how it has been solved in the great industrial countries of Europe.

Convinced that any further amendment of the anti-trust law so as to make it more rigid would be futile, and that the problems of combination in restraint of trade are too complex to be handled by the courts, the author proposes to allow a measure of "co-operation" and to turn over to industrial commissions the regulation of industrial corporations "affected with a public interest." All businesses which restrain trade to such a degree as to control the market by that fact, in the author's opinion, become of public interest. The distinction between what Professor Van Hise calls "co-operation" and what the law now bans under the name of combination is not always clear. He would permit co-operation, even including that which would fix prices and outputs, but it must be "reasonable co-operation" and must fall short of monopoly. A considerable number of amendments to the Sherman law as written, amended and construed by the courts are proposed, all these amendments being aimed to make procedure easier for the aggrieved and at the same time, under adequate regulation, to protect business that is conducted in a manner not injurious to the general welfare.

Professor Van Hise can claim approval of this program by many high authorities who have arrived at the conclusion that the trust problem must be turned over to commissions, on the same theory, and in much the same way, that public-service corporations are now controlled. This volume is a good exposition of the theory as applied to industrial corporations and embodies an elaborately worked out method by which the theory may be put into practice. For these reasons it is useful and timely.

New Apparatus and Appliances

INDICATOR FOR CONTRASTING LAMP CONSUMPTIONS.

The Warner "automatic watt indicator" is an exhibition device for indicating the difference in consumption between two lamps or other units. In shape it simulates an indicating wattmeter, but it contains no measuring elements, the readings of the pointer being set by stops which are adjustable. A flasher mechanism in the box turns on first one lamp and then the other, while the pointer is supposed to compare the watts taken by each. Thus, if a 25-watt tungsten is being compared with a 16-cp carbon lamp, the stops are set respectively at 25 watts and 55 watts on the scale, and solenoids pull the points to the corresponding readings as the lamps are successively lighted. The device is manufactured by the Warner Lamp Company, Muncie, Ind., and Wilton Junction, Ia.

MOTOR-DRIVEN WASHING MACHINE.

The manifold advantages of the electric washing machine for the home have won for it a permanent place in the list of modern labor-saving devices. The principle of washing consists in forcing the soapsuds through the clothes. Before the advent of the washing machine, this was accomplished by rubbing the clothes against a board. The machine illustrated herewith utilizes the above principle by means of an electric motor which raises and lowers rust-proof metal funnels or basins through the soapy water. These basins are attached to a yoke which is in turn fastened to a center bar by thumbscrews. The bar is backed up by a compression spring that automatically adjusts the position of the basins according to the amount of clothes in the machine. The electric motor is mounted on the frame under the washpan in an accessible place from which it may easily be detached.

The machine is equipped with a wringer, which is also

Motor-Driven Washing Machine.

operated by the electric motor through a set of silent, inclosed bevel gears, the power being transferred from the washer basins by a clutch lever conveniently located near the bottom of the tub. This lever can be operated to transfer the power from wringer to washer or in the reverse direction without stopping the motor. The wringer can be reversed by a small lever located near the upper roll. A gas burner for heating the water is also attached to the frame of the washer under the bottom of the tank. This device will heat the usual quantity of water to the scalding point in from twenty to thirty minutes. The entire machine is mounted on channel steel legs and roller-bearing casters. It weighs about 130 lb. and can be conveniently wheeled about the floor. It is known as the "Easy" motor washer and is manufactured by Dodge & Zuill, Syracuse, N. Y.

A ⅛-hp motor is used and as above stated may easily be detached and made available for other household uses such as operating the ice-cream freezer, vacuum cleaner, food chopper, emery wheels and others. It is built by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

PORTABLE ILLUMINOMETER.

In response to the increasing demand in this country for a commercially accurate, portable apparatus for the measurement of both interior and exterior illumination, an instrument of British design and manufacture, termed the

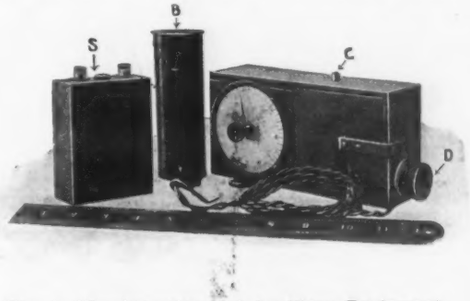


Fig. 1—Illuminometer and Auxiliary Equipment.

"luxometer," has recently been placed upon the market. The general appearance of the luxometer with its auxiliary equipment is shown in Fig. 1. The principle upon which it operates is a modification of the so-called Trotter method, in which the illumination from the incandescent lamp within

Fig. 2—Measuring Horizontal Illumination.

the case is adjusted until it equals the illumination to be measured. A pointer moving over a direct-reading scale indicates the measured illumination at once. A standard incandescent lamp is employed and can be satisfactorily operated from a small portable storage battery. Illumina-

tion measurements with the luxometer can be made at any angle. The surface brightness or intrinsic brilliancy of any surface can be quickly measured by viewing it through the instrument. Candle-power measurements can also be made readily. Fig. 2 illustrates the instrument in use, where it is shown in proper position for measuring horizontal illumination.

This instrument provides ready means for comparing the effective illumination of different objects, or of the same objects in different positions or under varying conditions. For example, the reflective qualities of different kinds of wall paper can be directly compared. The instrument is compact in bulk and weighs less than 2 lb. complete. The manufacturers state that it has been used in England to some extent. James G. Biddle, 1211 Arch Street, Philadelphia, Pa., is marketing the luxometer in this country.

ALTERNATING-CURRENT PRINTING-PRESS CONTROLLER.

The Carpenter type of printing-press controllers for direct-current circuits has long been used for the control of flat-bed presses. For use with alternating current the controller illustrated herewith has been developed and placed on the market by the Cutler-Hammer Manufacturing Company, Milwaukee. It is suitable for the speed control of

Alternating-Current Printing-Press Controller.

slip-ring induction motors driving printing presses, machine tools, etc. These controllers provide for seven forward speeds and two reverse speeds. Standard designs allow for 50 per cent speed reduction under full-load conditions. The resistor, except in the case of the 7.5-hp size, consists of one plate divided into three sections so that speed variations are obtained by inserting equal amounts of resistance in the rotor circuits. The resistance plate can be installed under the press or machine without danger.

RECORD-BREAKING CABLE REELS.

In February of this year the largest reel of armored submarine cable ever manufactured up to that time was shipped from the Hawthorne works of the Western Electric Company. This was a thirty-seven-pair, No. 13 gage armored cable containing approximately 80 miles of copper conductor and forming a continuous cable 5500 ft. long. The weight of cable, reel and blocking to hold it on the flat car was 38 tons. The reel heads were 9 ft. in diameter and 9 ft. apart. The cable was laid in Galveston Bay, Texas, connecting the lines of the Western Union Telegraph Company from Virginia Point to Galveston Island.

More recently there was shipped to the Cumberland Telephone & Telegraph Company the largest reel of duplex armored submarine cable ever turned out at the Hawthorne works. The cable contained twenty-six pairs of No. 13 gage copper conductor made up into a cable 4500 ft. long. To manufacture the cable there were required over 1000 lb. of paper, 15,000 lb. of lead, 47,000 lb. of wire and 7500 lb. of miscellaneous material. The gross weight of the reel with its blocking was 56 tons, or over 18 tons more than the first one described. This cable has been laid across the Mississippi below Vicksburg, Miss., connecting the toll lines between that city and Shreveport.

TROUBLE MAN'S PORTABLE SEARCH-LAMP.

Widespread interest has been aroused in the portable acetylene search-lantern for linemen, used by the Marion (Ind.) Light & Heating Company, described in the *Electrical World* of May 18, page 1076, resulting inquiries having reached the Marion company from all parts of the United States and from many foreign countries. The outfit comprises an adapted motorcycle lantern and Prestolite tank arranged with a carrying harness. The Electric City Sales Company, of Marion, Ind., has now arranged to furnish these outfits to central stations which wish to provide their linemen with these safety devices.

In practical use at Marion recently one of the outfits saved a lineman from almost certain electrocution by showing a 2300-volt wire which had dropped down to the height of the man's head. The man was in search of line trouble and was about to come into contact with the wire when the light from the lantern showed him his danger. Besides

Trouble Man Equipped with Portable Search-Lamp.

avoiding injuries to the man, an expensive case for the company was avoided. During a large fire in Marion, the firemen borrowed the central-station's search-lamps, and with their aid were able to reach and save property under conditions that with their ordinary oil lanterns would have made the task impossible. One dark night some time ago a limb of a tree fell across the Marion transmission line,

shutting down the service. The branch struck the center of the span, where it could not have been detected from the ground or from the poles until morning, but with the search-lantern the short-circuit was quickly detected and removed without delay.

FIBER INSULATION.

An insulating substance called "Disfico horn insulation" has recently been placed on the market by the Diamond State Fibre Company, Elsmere, Del. It is made from a specially prepared rope stock and contains no zinc, salts, chemicals or similar substances. It is tough and pliable, can be pressed or bent into any form and will not crack or become brittle with age. It is said to be well adapted for impregnating with insulating varnishes. It is manufactured in rolls or sheets from 0.005 in. to ⅛ in. thick.

WATT-HOUR METER SEAL.

There has been developed for the market by the Palmer Electric & Manufacturing Company, 161 Franklin Street, Boston, Mass., a watt-hour meter seal which, it is claimed, is so designed that it is impossible for an unauthorized person to replace it without committing the crime of forgery. In the accompanying illustrations Fig. 1 shows a meter with its seal and Fig. 2 the operation of installing the sealing member. The sealing member consists of a renewable paper cone which for convenience in handling is folded in a flat wafer; on it is printed any desired information such as a warning, a serial number or a distinguishing mark, specified by the user, as well as the signature of a responsible company officer. The cone is then treated with a waterproofing compound that permits the seal being further marked for identification by the operation installing it.

The seal holder consists of a metal cone having the same taper as the seal. It is inserted in the paper cone (see Fig. 2) and the seal wire is then engaged with the meter

Fig. 1—Sealed Meter.

and the seal holder. When the glass cylinder and locking cap are snapped into place it is impossible to open the seal without tearing the paper at two distinct points. The torn places are instantly apparent in the event of the seal being again closed with the same paper. A glance at the seal in Fig. 1 will show the appearance of a seal that has been opened and closed.

The paper cone cannot be fraudulently replaced without that act being plainly apparent, except by a very skilful preparation of a sealing cone as well as a deliberate reproduction of the signature of a company officer. As it cannot be accidentally torn, an attempt at illegal opening is at once apparent.

Though the device has sufficient mechanical strength to

Fig. 2—Installing Sealing Member.

meet all service conditions, it is apparently fragile; but as neither the breaking of the glass cylinder nor the cutting of the seal wire will defeat its object, its fragility is a matter of appearance only. It is impossible to insert a new seal wire or cut and then braze the original without destroying the seal.

STREET LIGHTING WITH FLAMING-ARC LAMPS.

The adoption of a new lighting system for Federal Street, Pittsburgh, Pa., has been brought about by the influence of the North Side Board of Trade, Pittsburgh. Recently the grade of Federal Street has been raised considerably in order to place it above the flood level. With the street in a much better condition than previously, it was decided to complete the improvements with an efficient lighting system.

After an investigation of the subject the long-burning flaming-arc lamp recently placed on the market by the Westinghouse Electric & Manufacturing Company was adopted. This is the same type of lamp that was used to illuminate

Night View of Federal Street, Pittsburgh, Pa.

the hall at Baltimore where the Democratic national convention was held.

There are installed ninety lamps in all, each with the commercial rating of 3000 cp. The street is 48 ft. wide and the lamps are placed 60 ft. apart. They are hung on ornamental poles of colonial pattern 25 ft. high with ornamental goosenecks.

INSULATING COVER FOR CABLE CONNECTORS.

A special form of insulating cover for use with Dossert connectors has recently been placed on the market. This cover is applicable only to connectors for joining conductors ranging in size from No. 0 B. & S. gage to 250,000

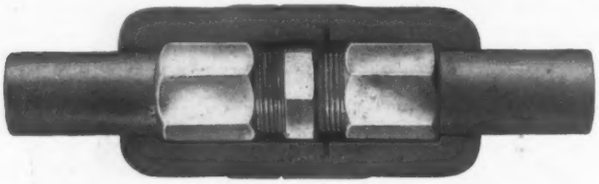


Fig. 1—Cross-Section of Insulating Cover.

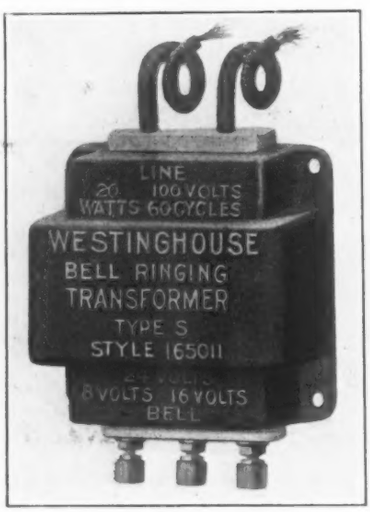
circ. mil. The general construction is shown by the cross-sectional view in Fig. 1. It differs from the insulating covers furnished for connectors used with wires smaller than No. 0 B. & S. in the respect that it is held in place by means of shoulders at the outer ends of the connector, instead of at the center. The covers, as shown, are made in two parts with a threaded coupling. The conductor openings range from 25-32 in. to 29-32 in., accommodating various thicknesses of insulation. Fig. 2 shows the appearance of a completed joint with its cover. The manufacturer states that other sizes will be added as occasion

Fig. 2—Cover for Cable Connector.

requires. These insulating covers and connectors are marketed by Dossert & Company, 242 West Forty-first Street, New York, N. Y.

BELL-RINGING TRANSFORMERS.

A new type of bell-ringing transformer has been brought out by the Westinghouse Electric & Manufacturing Com-



Bell-Ringing Transformer.

pany, East Pittsburgh, Pa. It is light in weight, fireproof and practically indestructible, so that it can be mounted in any out-of-the-way place. It will deliver on open circuit 8, 16 or 24 volts. It is stated that the coils and magnetic circuit are vacuum-dried and impregnated with a moisture-proof insulating compound before insertion into the case. The interior of the case is filled with a specially treated cement, with the result that the coils and iron are completely embedded in a fireproof and indestructible compound, which prevents the bell-ringing circuit coming in contact with the 110-volt circuit. Rubber-covered primary leads are brought out of the top of the case through porcelain bushings. Binding posts are provided, as shown in the illustration, for the bell circuit, and the transformer is mounted by lugs cast on the case for this purpose. These lugs are so arranged that an air space is provided between the transformer and the wall. A test of 2500 volts for one minute is applied between the primary windings and the secondary winding and case.

FUSED SWITCH BOX.

An improved combined switch and fuse box for 250-volt direct-current circuits has recently been brought out by the D. & W. Fuse Company, Providence, R. I. These boxes are particularly adapted for mill service, since they may

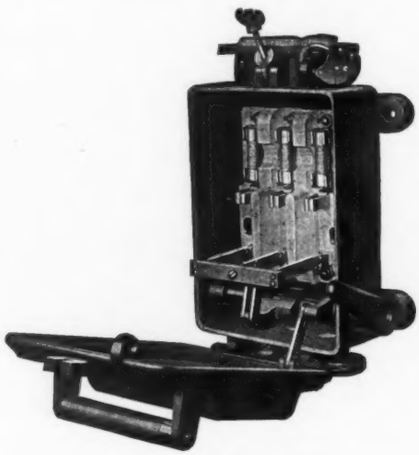


Fig. 1—Fused Switch Box.

be permanently locked after the fuses are installed, thereby making it impossible to tamper with the connections. At the same time they can be used as a switch since the circuits can be opened or closed at will by simply moving the lever at the side of the box. When the cover is opened

Fig. 2—Fused Switch Box.

the circuit is also opened, which makes it impossible to re-fuse the circuit when the switch is closed.

The boxes are provided with rubber gaskets which render them waterproof provided that the terminal wires are taped in at the bushings or protected by outlet hoods.

Industrial and Financial News

ADVANCEMENT of the fall season, bringing with it the harvesting of the unusually large crops that were predicted earlier in the year, is resulting in further progress along industrial lines. The more favorable reports are naturally coming at this time from the West and Northwest. Improvement in collections, a firmer tone in the money markets, an increase of nearly 5 per cent in bank clearings last week over those in the week preceding it, scarcity of labor and of railroad cars, increases in traffic returns and an ascending trend in the metal markets are among the signs of expansion in the commercial field. Indications of a belief in decided and not far distant improvement in the demand for electrical equipment are found in the sale of $10,000,000 debenture bonds by the General Electric Company. Other signs of confidence in the future growth of the electrical industry may be seen in the recent action of the board of directors of the Westinghouse Electric & Manufacturing Company in raising the common stock to only a 4 per cent per annum instead of a higher basis, as had been expected, with a view to conserving the surplus earnings toward improvement of property and working capital. The reorganization of the Garwood Electric Company into the C. & C. Electric & Manufacturing Company, noted below, will be of interest to those who have followed the history of this pioneer in the electrical manufacturing field. From the public-utility viewpoint the centralization of ownership and operation continues to be the most prominent tendency in this field. Earnings of many of the public-utility companies are showing favorable rates of increase.

Satisfactory Conditions in the Mica Market.—According to one of the leading importers of high-grade mica in the East, the present conditions and outlook in the mica market are highly satisfactory. "Demand for high-grade mica," he said, "is very evenly distributed throughout the year. The various mica consumers, of which the electrical and the stove manufacturing industries are the largest, all have their individual periods or seasons of greatest activity, and the diversity of these seasons results in a fairly constant and uniform demand for mica at nearly all times. Just at present we are receiving a greater volume of inquiries and orders than we did a little earlier in the year—a little better, I mean, than what has been regarded as normal in the past two or three years. This increase is not especially large, but the fact that it exists may be taken as an indication of commercial expansion throughout the country. Prices have been getting higher steadily for the past three years; but they are now as high, I think, as they will be for a little while to come. The consumer naturally takes more interest in the market when he can feel that prices are on a fairly stable basis. Roughly speaking, there has been an increase of some 20 per cent in prices in the last three years, although some grades have advanced as much as 33⅓ per cent. During the present year quotations have advanced about 10 per cent over those in 1911. I am speaking, of course, only of high-grade imported mica. We do not pay much attention to the domestic grades. The domestic mica, while large in the aggregate, is not as fine in quality as the imported, and the supply is not uniform or reliable. Most of the better grades are imported from India and Canada. Size of the pieces is one of the chief factors governing cost, the larger pieces bringing the higher price per pound. The greater part of the mica obtained from India is known as 'splittings,' which are thin films. They are made up into 'mica plates' in this country. Amber mica, so designated by its color, comes from Canada and is used especially for commutators. The rates of duty on mica are as follows: On unmanufactured, or rough trimmed, 5 cents per pound, plus 20 per cent; on ground mica, 20 per cent, and on cut or trimmed mica, mica plates or built-up mica, 10 cents per pound, plus 20 per cent."

C. & C. Electric & Manufacturing Company Succeeds Garwood Electric Company.—The C. & C. Electric & Manufacturing Company has purchased the good-will, patents and other assets of the Garwood Electric Company and will continue the manufacture of the special lines of electric apparatus developed by that company and by its predecessor, the C. & C. Electric Company. Notwithstanding these changes of name, the factory at Garwood, N. J., has been in continuous operation for nearly twenty years, some of the employees having been identified with the business when the manufacturing was done in New York before removal to Garwood, while the records of the business run back to 1882. It is, therefore, one of the oldest electrical manufacturing enterprises in the country. Its specialties will include planer motors, newspaper press drives, electric welding sets, wireless equipments and slow-speed motors for modern steam-heating and ventilating systems. The company will not manufacture machines of large capacity, but will confine its energies to the manufacture and sale of its specialties. It has agreed to complete all of the unfilled orders of the Garwood Electric Company and is said to be amply financed and free from the many handicaps of the Garwood Electric Company arising from lack of sufficient working capital. The officers of the new company are: Alexander Chandler, president; Edward D. Floyd, vice-president; Charles L. Hyde, treasurer. These, with John A. Montgomery and B. W. Johnson, constitute the board of directors. The capitalization consists of $250,000 7 per cent cumulative preferred and $250,000 common stock and there is no bond issue or other lien on the property.

General Electric Sells Debentures.—A block of $10,000,000 5 per cent debenture bonds has been sold by the General Electric Company to J. P. Morgan & Company. It will be recalled that when the company decided to increase its capital stock from $80,000,000 to $105,000,000 and to give $23,292,500 of this new stock to the shareholders as a 30 per cent dividend, as was noted in these columns July 27, the management in its announcement of the dividend said in part: "For the future financial needs of the company it is proposed to issue debentures from time to time, and for this purpose the board of directors has authorized an issue of debentures at 5 per cent or less, the total to be limited to $60,000,000." At the current dividend rate of 8 per cent the recent stock distribution will call for an additional dividend disbursement of $1,863,000 annually, and the bond issue just announced will increase the fixed charges $500,000 per annum. It is the policy of the company to maintain a large working capital, a large cash balance and to incur no floating debt. The business of the company is now understood to be running at a rate of about $93,000,000 per annum as compared with $70,000,000 last year. As the company already has a large working capital, it is supposed that adjustment financing or an additional volume of business requiring increased capital must be in sight to necessitate the issuance of these new bonds at this time.

To Furnish Electrical Energy in Utah Copper Region.—The Telluride Power Company, according to D. C. Jackling, vice-president and general manager of the Utah Copper Company, is to furnish energy to the latter for electrical operation of all of its properties, including a mine at Bingham, the smelter at Garfield, a mill at Magna, Utah, and also for operating the pumping stations connected with these works. The Bingham & Garfield Railroad will also be equipped for electrical operation. The Utah Copper Company is now using about 6000 hp of electrical energy supplied by the Telluride company and is also obtaining such other energy as is needed from a steam station at Magna. When the new contract with the Telluride company, calling for a total of 14,000 hp, is ratified, this steam plant will be discontinued. Plans for the equipping of the company's steam shovels for electrical operation are being made by its engineers.

Bondholders Purchase Mooresville (Ind.) Company.—The Mooresville (Ind.) Light, Heat, Power & Water Company has been purchased by the holders of the bonds, the consideration paid having been $60,000 on an appraised value, taken from the receiver's invoice, of $35,000. L. T. Keech, Indianapolis, acted as receiver for the Mooresville plant. The Mooresville company operates a steam-heating service and also controls the local Arctic Ice Company.

Reorganization of Merchants' Heat & Light Company, Indianapolis.—Indianapolis newspapers during the last month have contained a number of speculative accounts of supposed mergers between the two local central-station companies, as well as of the importation of water-power from Kentucky and Tennessee hydroelectric plants following the presumed acquirement of the Indianapolis properties by certain prominent Chicago syndicate interests. These reports have been publicly denied by Edwin L. McKee, president of the Merchants' Heat & Light Company, who has insisted that neither Insull nor Byllesby interests are concerned in the reorganization of the Merchants' property now going on. Possibilities of a local merger are also scouted by T. A. Wynne, vice-president, treasurer and general superintendent of the Indianapolis Light & Heat Company, who declares that the older company does not intend to dispose of its holdings and expects to continue operation of its system as in the past. Under the Indiana state law, competitive utilities cannot be merged unless every share of stock is voted favorably. The Merchants' Heat & Light Company has, however, been reorganized during the past week, a holding company, the Merchants' Public Utilities Company, being formed with a capital stock of $4,000,000, to be subscribed by Indianapolis, Louisville and Chicago interests. This stock will be divided into two issues, $2,000,000 common and $2,000,000 preferred. Half of the preferred issue has been contracted for sale to Henning, Chambers & Company, Louisville; L. C. McHenry & Company, Louisville, and George Eustis & Company, Cincinnati. A bond issue of $6,000,000 has also been authorized and sold to the Harris Trust and Savings Bank, Chicago. The Union Trust Company, Indianapolis, will act as co-trustee with the Harris bank. With the Merchants' Public Utilities Company as the holding concern, the Merchants' Heat & Light Company will continue operation with the same set of officers. These are: President, E. L. McKee; secretary, C. M. Polen; directors, F. M. Ayers, E. G. Efroymson, Henry Kahn, Charles Mayers and E. L. McKee. During the last three months the Merchants' company has expended nearly a third of a million dollars in improvements to its plants. The newer West Washington Street station is one of the largest exhaust-steam-heating plants in the country. The Merchants' company has moved its general offices from the old location at 18 South Pennsylvania Street to temporary quarters on North Meridian, near Vermont. After Oct. 1 it will remove to its new permanent headquarters in the Merchants' Bank Building, 33 and 35 South Meridian Street, Indianapolis.

Electrification Prospects at Boston.—At the annual meeting of the stockholders of the Boston & Providence Railroad Corporation on Oct. 9 at Boston, Mass., the owners of the company will be asked to vote upon an eight-million-dollar bond issue for the electrification of the main line leased by the New York, New Haven & Hartford Railroad between the above cities, in accordance with an act of the last Legislature. In connection with this meeting the directors have issued a circular letter recommending a favorable vote upon the electrification project and pointing out that unless the railroads voluntarily undertake to adopt electric motive power legislative enactment toward that end with possible adverse changes in charters will result. The directors call attention to the willingness of the New Haven management to do its part in the work, although the latter cannot be expected to electrify at its own expense, as all improvements upon the road become the property of the Boston & Providence stockholders at the expiration of the present lease in 1987.

Boston Edison Earnings Increase.—The Edison Electric Illuminating Company of Boston, Mass., reports for August gross earnings of $403,391, a gain of $37,748 over a year ago, and a gain in net for the month of $17,180. In the past two months the company's gross earnings have increased $68,342, compared with the corresponding period in 1911. A considerable amount of temporary service is now handled by the company, including the supply of energy for lighting and motor service in the construction of the Boylston Street subway, special illuminations, etc. The electric vehicle battery charging load is gaining steadily and many industrial applications of electric heating are being pushed. With the opening of the 1912 Electric Show at Boston on Sept. 28 an impetus will be given to electrical development in eastern New England which will soon be reflected in the company's patronage.

Another Long Acre Electric Light & Power Rumor.—The latest rumor concerning the Long Acre Electric Light & Power Company, which has been endeavoring for a number of years to gain an entrance into the central-station field in New York, is that a majority of the Long Acre company's $500,000 outstanding first-mortgage 4 per cent bonds, the interest on which has been long in default, changed hands at private sale this week, and that the new holders will begin proceedings for a foreclosure sale of the company's property with a view to obtaining control of the company and turning it over eventually to the New York Edison Company, thus ending the long litigation between the two concerns. Attorneys of the New York Edison Company state that they have no knowledge that such a move has been made.

Operations in Central Indiana.—The Interstate Public Service Company of Indianapolis has been incorporated with a capital of $1,000,000 in preferred and $2,000,000 in common stock. It will finance and operate public-service properties in Indiana and elsewhere. It is said that it will take over and operate the Indianapolis, Columbus & Southern Traction Company, recently leased by the Middle West Utilities Company of Chicago, and also the Central Indiana Company, which controls lighting and traction properties in Columbus, Ind., and electric-service companies in Greenwood, Franklin, Bloomington and Seymour, Ind. The capital stock of the Indianapolis, Columbus & Southern has been increased from $920,000 to $1,840,000.

First Dividend of Central States Electric Company.—The first quarterly dividend of 1¾ per cent on the preferred stock of the Central States Electric Company has been declared. It is payable on Oct. 1 to stockholders of record on Sept. 10. The Central States company, as was noted in these columns May 25 and July 6, was formed by Harrison Williams, of New York, and associates in May as a holding company for the 70 per cent of the common stock of the Cleveland (Ohio) Electric Illuminating Company that was secured by them earlier in the year.

Westinghouse Dividend Action Unanimous.—The action of the board of directors of the Westinghouse Electric & Manufacturing Company last week in placing the common stock on a 4 per cent basis was, it is understood, unanimous, the board being united in the belief that the policy of using earnings at this time to build up the properties and working capital is the most desirable course to follow. A further charging-off of about $2,000,000 would, it is understood, be sufficient to place the book valuation of the company's foreign investments upon a strong basis.

Harrisburg (Pa.) Light & Power Personnel.—Officers of the Harrisburg (Pa.) Light & Power Company, which recently secured control of the Harrisburg Light, Heat & Power Company and the Paxtang Electric Company, have been elected as follows: President, George Bullock; vice-president and general manager, George B. Tripp; secretary and treasurer, George W. Stone; assistant secretary, Henry Morgan; superintendent, Edward Z. Wallower, and general counsel, E. B. Mitchell. The company is capitalized at $2,000,000.

Financing Maryland Utility Company in London.—John Bogart, consulting engineer and chief engineer of the Youghiogheny Water & Electric Power Company, 141 Broadway, New York, says that while plans are being made for construction of the company's hydroelectric developments in western Maryland, near Friendville, full details will not be completed until the president of the company, who is now in London arranging for the financing, returns to this country.

Western Union's Business Shows Increase.—Gross earnings of the Western Union Telegraph Company for the fiscal year ended June 30 showed an increase of slightly more than 11.5 per cent over those in the preceding twelve months, which represents a total volume of business of close to $40,000,000 as compared with $34,714,000 in 1911. The expansion in earnings is attributed to the introduction of the night and day letter service.

Public-Utility Earnings Improving.—Steady improvement continues to be shown in the earnings of public-utility companies in various parts of the country. In the twelve months ended Aug. 31, 1912, subsidiaries of the American Gas & Electric Company showed increases in gross and net earnings, respectively, over the returns in the previous year as follows: Atlantic City (N. J.) Electric Company, 10 per cent and 22 per cent; Canton (Ohio) Electric Company, 14 per cent and 6 per cent; Muncie (Ind.) Electric Company, 22 per cent and 36 per cent; Rockford (Ill.) Electric Company, 8 per cent and 22 per cent; Scranton (Pa.) Electric Company, 9 per cent and 7 per cent. The Dayton (Ohio) Power & Light Company's statement shows an increase of 9.97 per cent in gross and of 27.46 per cent in net earnings in the eight months ended Aug. 31, 1912, as compared with returns in the corresponding period of the previous year, while an increase of 115 per cent is shown in the surplus, after all deductions, in the 1912 period. The report of the Federal Light & Traction Company for the seven months ended July 31, 1912, shows a gain of 14.7 per cent in gross and of 17 per cent in net as compared with returns in 1911. The Milwaukee Electric Railway & Light Company in the eight months ended Aug. 31 showed a surplus over dividends and charges of nearly $55,000, as against about $11,000 in the same period last year. The Consumers' Power Company, in the first eight months of this year, made an increase of about 17½ per cent in its gross and 12½ per cent in its net earnings as compared with the showing in the previous year. Owing to substantial increase in preferred stock dividends and charges, the surplus over these items showed a falling off of some 18 per cent, however. The report of the Edison Electric Illuminating Company of Boston for the fiscal year ended June 30, 1912, reference to which appeared in the *Electrical World* last week, showed a gain of over $500,000 in gross and of about $200,000 in net, as compared with the 1911 showing. Attention is called to the substantial gains recorded in the August statement of the company, noted on page 680 of this issue. The Kings County (N. Y.) Electric Light & Power Company and its operating company, the Edison Electric Illuminating Company of Brooklyn, in the eight months ended Aug. 31 showed an increase of $341,309 in gross, of $80,352 in net operating revenue and of $23,783 in surplus over charges. The August statement, while showing an increase of $17,225 in gross, showed a decrease in net operating revenue of $21,351 and of $29,806 in surplus over charges for the month as compared with returns in August, 1911. Increased depreciation and operating charges were the causes of the falling off. The recent reduction in lighting rates made voluntarily by the company (*Electrical World*, April 27, page 886) is expected to induce more than sufficient new business to offset any decrease in revenue that results from the reduced schedule.

Merchants' Company, Indianapolis, to Buy 10,000-kw Turbine.—E. Darrow, general manager of the Merchants' Heat & Light Company, Indianapolis, Ind., has announced that his company is prepared to receive bids for a 10,000-kw steam turbine for its West Washington Street staion.

NEW YORK METAL MARKET PRICES.

	Sept. 17		Sept. 24	
Copper:				
Standard:	Bid.	Asked.	Bid.	Asked.
Spot	17.25	17.50	17.25	.....
September	17.25	17.50	17.25	.....
October	17.25	17.50	17.25	.....
November	17.25	17.50	17.25	.....
December	.....	.....	17.25	.....
London quotation:	£ s d		£ s d	
Standard copper, spot	78 5 0		78 17 6	
Standard copper, futures	79 2 6		79 17 6	
Prime Lake	17.65 to 17.75		17.65 to 17.75	
Electrolytic	17.60 to 17.70		17.65 to 17.75	
Casting	17.50		17.60	
Copper wire, base	19.00		19.00	
Lead	5.10		5.10	
Sheet zinc, f.o.b. smelter	8.90		8.90	
Spelter, spot	7.55		7.65	
Nickel	40.00 to 41.00		45.00	
Aluminum:				
No. 1 pure ingot	21½ to 22½		21½ to 22½	
Rods and wire, base	32		32	
Sheets, base	33½		33½	
OLD METALS.				
Heavy copper and wire	15.75		16.50	
Brass, heavy	10.00		10.50	
Brass, light	8.25		8.75	
Lead, heavy	4.85		4.75	
Zinc, scrap	5.87½		6.10	

COPPER EXPORTS IN SEPTEMBER.

Total tons, including.....Sept. 17, 13,624 Sept. 24, 19.203

STOCK MARKET PRICES.

	Sept. 18.	Sept. 25.
Allis-Chalmers	¾	⅝
Allis-Chalmers, pf.	4½	3¼
Amalgamated Copper	87¾	90¾
Amer. Tel. & Tel.	144⅛	146
Boston Edison	291	290*
Commonwealth Edison	138½	138½*
Electric Storage Battery	56¾	56⅜
General Electric	182¾	183¼
Mackay Companies, pf.	68¾	68½
Philadelphia Electric	24⅛	23⅞
Western Union	82	81⅞
Westinghouse	84⅞	85½
Westinghouse, pf.	124*	124*

*Last price quoted.

Personal

Mr. Douglas J. W. Metcalf, electrical contractor, of Seattle, Wash., has been appointed assistant superintendent of the Calgary Light & Power Company, Alberta, Canada.

Mr. Henderson W. Knott, American manager of the Morgan Crucible Company, Ltd., sailed for Europe on Saturday on the steamship *Caronia* for a month's sojourn in England.

Mr. Charles H. Clark, formerly chief engineer of the Connersville (Ind.) Light, Heat & Power Company, has been appointed manager of the Martinsville (Ind.) Light, Heat, Power & Water Company.

Mr. Thomas F. Kelly, contract agent of the Hamilton Cataract Power, Light & Traction Company, Ltd., Hamilton, Canada, has been appointed a member of the commercial committee of the Canadian Electrical Association.

Mr. Clemens Blank, formerly manager of the Martinsville (Ind.) Light, Heat, Power & Water Company, has removed to Indianapolis to become assistant superintendent of outside construction for the Indianapolis Water Company.

Mr. N. M. Argabrite, formerly manager of the electric-light company at Hartford City, Ind., has been appointed manager of the Elwood (Ind.) Electric Light Company, succeeding Mr. S. B. Harting, formerly manager there.

Dr. William Marconi met with an automobile accident on Sept. 25 in the Italian Riviera, near Borghetto, between Spezia and Genoa. In a collision with another automobile both cars were overturned. Dr. Marconi's right eyeball was badly bruised, although possibly not seriously injured.

Mr. Paul B. Sawyer, of the Electric Bond & Share Company, formerly manager of central-station properties in Des Moines and Dubuque, has been made vice-president and general manager of the Telluride Power Company of Colorado and Utah, succeeding **Mr. L. L. Nunn** as general manager.

Mr. E. T. Penrose, formerly general manager of the Penn Central Light & Power Company, Altoona, Pa., and more recently electrical engineer of the Pennsylvania Coal & Coke Company, has severed his connection with the latter concern and joined the staff of the Electric Bond & Share Company, of New York.

Mr. G. N. Lemmon has been temporarily appointed chief engineer of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio. Permanent appointment will be made later, as on Nov. 1 Mr. Lemmon will join the Railway & Industrial Engineering Company, of Pittsburgh, Pa., as consulting electrical engineer.

Mr. W. W. Brison has been appointed division manager of the Southern Sierras Power Company at San Bernardino, Cal., where he will have general supervision of all of the business of the company in that vicinity from the southern county line to the mountains in the north. The duties of the right-of-way agent are combined with the position of division manager in that territory.

Mr. George W. Elliott, of the *Electrical World*, has been appointed master of transportation of the National Electric Light Association, to succeed **Mr. Charles H. Hodskinson,** who has so capably filled this position for several years.

Mr. Hodskinson has had added to his work with the Edison Electric Illuminating Company of Boston so many new duties that he has found it necessary to be released from transportation matters.

Mr. Sidney G. Vigo, formerly connected with the contract department of the Commonwealth Edison Company of Chicago, and more recently in charge of the motor-service business of the Consumers' Electric Light & Power Company of New Orleans, has been appointed an assistant to Mr. M. S. Hart, general contract agent of the Middle West Utilities Company of Chicago, in charge of motor-service business. Mr. Vigo will make his headquarters in Chicago, but will travel a good deal among the recently acquired properties of the Middle West company.

Mr. F. C. Loring, formerly connected with the Marion (Ind.) Municipal Electric Light Plant and afterward with the Metropolitan Street Railway Company of New York, has been appointed instructor in electrical engineering at the University of Illinois. Mr. Loring, who was born at Marion, Ind., was graduated from Purdue University with the degree of bachelor of science in electrical engineering in 1904 and from Columbia University with the degree of master of arts in 1907. He was instructor in experimental engineering at Cornell University, 1907-8.

Mr. Nathaniel A. Carle, whose retention by the Public Service Electric Company, Newark, N. J., was announced in these pages last week, has been appointed chief engineer to succeed Mr. James T. Whittlesey, resigned. Mr. Carle is a native of Portland, Ore., and was graduated from Leland Stanford University, at which institution he received his degree in electrical engineering. For ten years he was connected with Westinghouse, Church, Kerr & Company, after which he spent two years as second in command of the construction work of the Pennsylvania Railroad Company's power station in Long Island City. He next engaged in hydroelectric development work in the northern part of Colorado and subsequently became affiliated with the Puget Sound Bridge & Dredging Company, Seattle, Wash. Mr. Carle has for some time been associated with Professor Lucke of Columbia University in experimental and testing work. He is thirty-eight years old and is a member of the A. I. E. E., the A. S. C. E. and the A. S. M. E. **Mr. E. B. Meyer** has been made assistant to the chief engineer of the company, **Mr. H. L. Pallard** electrical engineer, and **Mr. S. H. Kent** mechanical engineer, the last three changes being in the nature of promotions.

Obituary

Mr. Alfred Fitler Moore, wire manufacturer of Philadelphia, died at his home in that city on Sept. 18. Mr. Moore, who was fifty-six years old, was born in Philadelphia and succeeded to the business established by his grandfather, who conducted what was said to be the first company in this country to manufacture insulated wire for electrical work. The deceased was also president of the Northern Liberties Gas Company and a director of the Bank of Northern Liberties, of the Franklin Fire Insurance Company and of the old Second and Third Streets Passenger Railway Company. He was also prominent in club circles, being a member of the Junior League and of the Bachelors' Barge Club. He is survived by his widow and a brother.

Mr. James H. Wise, assistant general manager of the Pacific Gas & Electric Company of San Francisco, Cal., died Sept. 16 in the Merritt Hospital at Oakland, Cal., whither he had been taken the previous night from Caliente. Mr. Wise was making an automobile inspection trip of the Los Angeles aqueduct for the purpose of getting information of value to him in the construction of the hydroelectric development of his company at Spaulding and on Bear River, where work is under way on a 53,000-hp station. A leak developed in the gasoline tank of the car, and while Mr. Wise was emptying the tank in order to effect repairs the torch used to heat a soldering iron ignited the gasoline and Mr. Wise was enveloped in flames and fatally burned. The deceased was thirty-three years old and a graduate of the University of California in mining engineering. After teaching mathematics for a year he entered the employ of the Pacific Gas & Electric Company in 1904, becoming an assistant to Mr. F. G. Baum, and on the latter's resignation he was appointed hydraulic and civil engineer of the company. Early in 1910 he joined the consulting engineering firm of Messrs. F. G. Baum & Company, but was still retained in a consulting capacity by the Pacific Gas & Electric Company. In July, 1911, he was made assistant general manager of the Pacific Gas & Electric Company with entire charge of the construction and extension of the steam and hydroelectric plants which the company is building. His untimely death came as a shock to his numerous friends and associates. Mr. Wise is survived by his mother.

Mr. James Dix Schuyler, who died last week at his home near Los Angeles, Cal., was born at Ithaca, N. Y., May 11, 1848. He was educated at Friends' College. From 1869 to 1873 he engaged in railway construction in Colorado, and in the latter year went to California. He was assistant state engineer of that State from 1878 to 1882, was chief engineer and superintendent of the Sinaloa & Durango Railroad, Mexico, 1882-84, and built the Sweetwater Dam in 1888, and later the Hemet Dam, the highest masonry dam in Western Australia. He engaged in building large power plants in California and Mexico and extensive works for irrigation and power development in Mexico, Brazil, New Mexico, Colorado and other Western States. He was a member of a commission of engineers on the Los Angeles city aqueduct and was consulting engineer to the territorial government of Hawaii on the construction of the Nuuanu Dam; to the Monterey Water Works and Sewer Company, Ltd., Mexico; to the Kobe syndicate on an extensive power project in Japan, involving a very high dam; to the Mexican Light & Power Company, Ltd., on the building of four large dams for power in Necaxa Valley, Mexico, and to the Vancouver Power Company, Ltd., Vancouver, B. C., on the building of a dam at Coquitlam Lake. He was a member of the commission of engineers appointed by President Roosevelt to accompany President-elect Taft to Panama in January, 1909, to decide finally on the type of canal. He was the author of "Reservoirs for Irrigation, Water Power and Domestic Supply," 1901. For two years, in 1888 and 1896, he was the winner of the Rowland prize for the best papers of the year read before the American Society of Civil Engineers, of which he has been vice-president.

Mr. John Thomas Cowling, electrical engineer of the Westchester Lighting Company, Mount Vernon, N. Y., died at Fullerton, Cal., on Sept. 18, after a lingering illness. Mr. Cowling was born in England Dec. 21, 1862, and came to Wilkes-Barre, Pa., with his parents at the age of four. His early education was limited, as he was obliged to leave school at the age of nine owing to the death of his father. He acquired his first electrical experience with the telephone and lighting companies in Wilkes-Barre, and later became connected with the Powellton Electric Company of Philadelphia, where he served as general manager from 1890 to 1900. In January, 1900, he was sent by the United Gas Improvement Company to act as superintendent of the Hudson River Gas & Electric Company of Tarrytown, N. Y., and in December of that year he was made engineer of the electrical department of the Westchester Lighting Company, which position he held at the time of his death. Too close application to work resulted in breakdown, and in March, 1911, he went to the Pacific Coast for rest, returning to New York in June of that year. His health began to fail again, however, and last December he went to Denver, then to Phœnix, Ariz., and finally to Fullerton, Cal., where he died. Mr. Cowling was highly esteemed by all who knew him, and his breakdown a year ago was keenly felt by his associates. He is survived by a wife, a son and a daughter.

JOHN T. COWLING

Construction

ANNISTON, ALA.—The Alabama Pwr. Devel. Co. has purchased a site of 16 acres in Anniston on which it proposes to erect a transforming and distributing station.

GADSDEN, ALA.—The Alabama Pwr. Devel. Co. has purchased 80 acres of land in East Gadsden, which will be used as a site for a large auxiliary steam plant and other purposes. Work will soon begin on construction of the proposed plant.

RAGLAND, ALA.—Preparations are being made by the Ragland Wtr. Pwr. Co. to begin work on a water-power development on the Coosa River at Ragland, to cost about $500,000. From 6000 hp to 10,000 hp will be generated for transmission by electricity. Senator W. T. Brown is interested.

TUSCALOOSA, ALA.—The Tuscaloosa Ice & Lt. Co. has submitted a proposition to the city commissioners asking for a franchise for an electric street railway and an extension of the present street-lighting contract with the city for a period of seven years.

TUSCALOOSA, ALA.—The city commissioners are considering a proposition submitted by the Birmingham Gulf & Navigation Co. relative to equipping its street-car line for electrical operation. The company also asks for a franchise to generate electricity for lamps and motors.

WILLIAMS, ARIZ.—Work will begin at once by the Atchison, Topeka & Santa Fé R. R. Co. on the construction of a concrete power house, 78 ft. x 100 ft. A plant for treating water for locomotives will also be erected.

BENTONVILLE, ARK.—The Bentonville Lt. & Wtr. Co. is installing meters throughout its entire system. The company is in the market for a two-phase generator and contemplates erecting a transmission line to the municipal water-works pumping station to supply electricity to operate the pumps. Carroll Holt is superintendent.

BAKERSFIELD, CAL.—The Hale-McLeod Oil Co. has decided to install electric motors in its two properties.

FORT BIDWELL, CAL.—At the last session of Congress an appropriation of $15,000 was made for construction work at the Indian School at Fort Bidwell, including construction of water-works and electric-light plant, to cost $7,000; steam laundry, $3,000, and $2,000 for complete heating system.

GLENDALE, CAL.—The city lighting system will be extended to Verdugo Canyon, which was recently annexed to the city.

HUNTINGTON BEACH, CAL.—The city trustees have decided upon an ornamental street-lighting system. Forty-five ornamental lamp posts of reinforced concrete, each carrying three lamps, will be used. The cost is estimated at about $1,200.

LOS ANGELES, CAL.—The City Council has authorized City Attorney Shenk to draft an ordinance providing for a special engineering force to prepare maps of the entire conduit system in the streets of the city. The cost of preparing the maps is estimated at $12,000. The plans are being prepared with a view of determining where the conduits for the aqueduct power distribution may be advantageously placed.

LOS ANGELES, CAL.—Sealed proposals will be received at the office of the United States Reclamation Service, Federal Building, Los Angeles, until Oct. 11 for furnishing electrical apparatus, including 275-hp motors, one 30,000-volt oil circuit-breaker, three 30,000-volt single-phase, expansion fuses, two automatic controllers, three 50-kva transformers, one 1-kva transformer and one three-phase electrolytic lightning arrester. O. H. Ensign is consulting engineer.

REDLANDS, CAL.—The Southern California Edison Co. is planning to extend its transmission lines throughout the Yucaipa Valley to supply electricity to operate pumping plants and for lamps in the valley. W. L. Frost is local manager.

SACRAMENTO, CAL.—The Vallejo & Northern El. Ry. Co. is planning to double-track its system within the city limits.

SAN BERNARDINO, CAL.—The Southern Sierras Pwr. Co., which is erecting 225 miles of steel tower line from Bishop Creek to this city, recently lost 18 towers which were overturned by a heavy wind; several more were partly overturned.

SAN FRANCISCO, CAL.—The contract for the electrical work at the San Francisco Hospital has been awarded to the Butte Engr. & El. Co., 683 Howard Street, San Francisco, at $11,900.

SAN FRANCISCO, CAL.—The Board of Supervisors has passed an ordinance authorizing the city engineer to prepare plans and estimates of the cost of the installation or the acquisition of a municipal telephone system.

SAN MATEO, CAL.—Ansel M. Easton has entered into a contract with Mahoney Brothers for the construction of an electric railway, which will extend from the Easton Hills to the Easton Station and connect with the suburban lines of the United Railroads. The cost of the railway with power houses and rolling stock is estimated at about $75,000.

SOUTH PASADENA, CAL.—The City Trustees are considering the installation of a modern police call system and an up-to-date fire-alarm system.

TULARE, CAL.—The Big Four El. Ry. Co., of Tulare County, has received authority from the State Railroad Commission to issue $100,000 in capital stock, the proceeds to be used for construction of its road. The company proposes to build a railway from Tulare to Porterville via Woodville and Poplar, a distance of about 34 miles.

CREEDE, COL.—The Creede Triune Pwr. Co. is building a steam electric generating plant in Creede to supply electricity for three mines in this vicinity. Webber & Possett, of Denver, are engineers.

WILMINGTON, DEL.—The Wilmington & Philadelphia Trac. Co. is planning to install an electric distributing system in the Cedars, a residential suburb, to supply electricity for lighting.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 7 for furnishing lamp standards and brackets that may be required for the various buildings under control of the department. Copies of drawings and specifications may be secured at the above office. Oscar Wenderoth is supervising engineer.

WASHINGTON, D. C.—Sealed bids will be received at the office of the secretary, electrical engineer in charge of automatic scales, Treasury Department, Washington, D. C., until Oct. 9 for furnishing and installing complete automatic weighting and recording scales for customs service in accordance with specifications, copies of which may be obtained at the above office. James F. Curtis is assistant secretary.

MIAMI, FLA.—The Ocean Beach Amusement Co. is planning to establish an amusement park across Biscayne Bay from Miami. The improvements will include pavilion, water-works and electric-light plant, to cost from $10,000 to $15,000. C. A. Muller is secretary and general manager.

TAMPA, FLA.—The Tampa El. Co. is planning to erect cable houses on the river front, from which cables will cross under the river in trench to be blasted out, or in the event of the river being deepened, through tunnel to be bored. The cost of cable houses is estimated at $12,000 and that of equipment at about $20,000.

AMERICAN FALLS, IDAHO.—It is reported that the plant of the Idaho Consol. Pwr. Co. has been sold to the Kuhn interests, Pittsburgh, Pa. It is understood that the new owners will increase the output of the plant to 30,000 hp and extend the tranmission lines to Salt Lake City, Utah. James H. Brady is president of the Idaho Consol. Pwr. Co.

HAILEY, IDAHO.—The Rockwell White Pwr. Co. has submitted a proposition to the City Council offering to furnish electricity for lighting the streets of the city for a period of ten years, to begin not later than Jan. 1, 1913.

BARRY, ILL.—The plant of the Barry El. Lt. & Pwr. Co. has been purchased by the White-Hall syndicate, which is buying all the electric plants between Hull and Chapin and is now making arrangements to erect a transmission line between the towns. The new owners will secure electricity from the Keokuk Pwr. Co., which has decided to erect a substation at Hull, to cost about $60,000.

BELVIDERE, ILL.—The Illinois Northern Utilities Co. has applied to the City Council for a new 50-year franchise in this city.

CHAMPAIGN, ILL.—The West Park Avenue residents have appointed a committee, consisting of C. A. Kiler, N. M. Harris and Dr. C. H. Peres, to report on the installation of an ornamental street-lighting system.

ELGIN, ILL.—A proposition to create a bond issue next spring for the purpose of establishing a municipal electric-light plant will be submitted to the voters. The present contract for street lighting will expire in 1915.

FARMINGTON, ILL.—The Farmington Lt. & Pwr. Co. has entered into a contract with the Maplewood Coal Co. to supply electricity to operate the machinery at its No. 1 mine.

MOLINE, ILL.—The City Commission will ask for bids for lighting the new city hall.

NEOGA, ILL.—The Village Council has granted the Central Illinois Pub. Ser. Co. a franchise to furnish electricity in Neoga. The company has also been awarded a 10-year contract for lighting the streets of the village. A transmission line will be erected from Mattoon, which will also supply electrical service in the village of Etna and may be extended to Effingham.

OTTAWA, ILL.—The Board of Supervisors of La Salle County has granted the La Salle County El. Co. a franchise to erect and operate transmission lines along the highways of the county for a period of 20 years.

PEORIA, ILL.—The City Council has passed a resolution authorizing an ordinance to be drawn revoking the franchise of the Central Union Tel. Co.

PEORIA, ILL.—The Board of County Supervisors has authorized the committee of poor farm inspectors to install an electric-light plant at the county farm, the cost not to exceed $2,500. If it costs more, the committee is to secure estimates and report to the board.

PLAINVILLE, ILL.—Plans are being considered by representatives from Plainville, Payson, Kinderhook, Hall and Barry to organize a company to distribute electrical energy in those towns from the plant of the Mississippi River Pwr. Co. at Keokuk.

RICHMOND, ILL.—The Public Service Co. of Northern Illinois is reported to be seeking a franchise to operate an electric distributing system in Richmond.

SPRINGFIELD, ILL.—The Springfield, Clear Lake & Southern Ry. Co. has announced that Clear Lake will be made a summer resort and that the railway will be extended from Rochester to Hillsboro soon. Dr. N. R. Gordon, of Springfield, is president.

ANGOLA, IND.—The Indiana Utilities Co. has taken over the properties of the Angola Lt. & Ry. Co., Angola, and of the Waterloo El. Lt. & Wtr. Wks. Co., Waterloo. A new transmission line will be erected from Angola to Pleasant Lake and Waterloo. The plant in Waterloo will be closed down. Electricity will be supplied from the Angola plant in Pleasant Lake, Waterloo and several other adjoining towns. E. J. Condon is president of the new company.

CROWN POINT, IND.—Proposals will be received by the Board of Commissioners of Lake County until Oct. 9 for lighting fixtures for use at the county farm. Charles A. Johnson is county auditor.

HOBART, IND.—Plans are being prepared for the installation of a new street-lighting system on Front, Main and Fourth Streets and to continue along the boulevard.

INDIANAPOLIS, IND.—Preparations are being made by the Indianapolis Lt. & Ht. Co. to enlarge its Mill Street power house. A 10,000-kw steam turbine will be installed and a new boiler room paralleling the present steam units will be equipped with boilers of 7000 hp.

INDIANAPOLIS, IND.—The Merchants' Ht. & Lt. Co. is planning to install a 10,000-kw steam turbine in its West Washington power station, for which it is prepared to receive bids. The company has been reorganized, a holding company, the Merchants' Public Utilities Co., being formed with a capital stock of $4,000,000 to control it. E. Darrow is general manager of the Merchants' company.

MARTINSVILLE, IND.—The property of the Martinsville Lt., Ht. & Wtr. Co. has been sold to the Reliance Engineering Co., of Cincinnati, Ohio, which operates electric public utility plants in Gosport and Spencer, nearby towns. Charles H. Clark has been appointed manager of the Martinsville company.

MONTPELIER, IND.—The new owners of the Montpelier Lt. & Pwr. Co. have reorganized and propose to apply for a new franchise in this city.

PLYMOUTH, IND.—In an effort to purchase the local electric-light plant, owned by C. D. Snoeberger, the City Council had an appraisement of the plant made by experts, which placed the value of the system at $71,000. The city refused to buy the plant at that price and is preparing to submit the question of installing a municipal lighting plant, to cost $40,000, to the voters. Preparations are being made by Mr. Snoeberger for the installation of additional machinery in his plant.

WARSAW, IND.—The Winona El. Lt. & Pwr. Co. is planning to replace the old arc lamps now in use with new lamps. The Council will be permitted to select the new lamps.

BLANCHARD, IA.—The proposition to grant the Lee El. Lt. Co., of Clarinda, a franchise to install an electric-light system here will be submitted to the voters on Sept. 30.

BURLINGTON, IA.—The Mississippi River Pwr. Co. has applied to the City Council for a 25-year franchise to supply electricity here from its plant in Keokuk.

COLLEGE SPRINGS, IA.—At an election to be held Sept. 30 the proposition to grant the Lee El. Lt. Co., of Clarinda, a franchise to install and operate an electric-lighting system here will be submitted to the voters.

FORT DODGE, IA.—Bids will be received by the board of directors of the independent school district of Fort Dodge until Oct. 10 for vacuum cleaners and electric-light fixtures for two school buildings now in course of construction. J. L. Porter is secretary.

GARDEN GROVE, IA.—The citizens recently voted to grant the Leon El. Co. a 15-year franchise to supply electrical service here. Electricity for operating the system will be transmitted from the plant at Leon. The company may possibly extend the line from Garden Grove to Humeston.

GILMORE CITY, IA.—At an election held recently the proposition to grant a 25-year franchise to H. W. Heath to construct and operate an electric-light plant here was carried.

HUXLEY, IA.—The Central Iowa Lt. & Pwr. Co., of Fort Dodge, has been granted a 25-year franchise to construct and operate an electric-light and power plant here. The company operates an interurban railway through the town.

LISBON, IA.—The Town Council has decided to install ornamental street lamps in the business district. The plans call for 16 standards carrying four lamps each.

MARBLE ROCK, IA.—Plans are being considered for the installation of a municipal electric-light plant. It is proposed to develop the water power of Shell River to supply power to operate the plant.

MELROSE, IA.—The installation of an electric-light and power plant here is under consideration. Mark Carmody is interested.

SHELDAHL, IA.—At an election to be held Oct. 12 the proposition to grant the Boone El. Co. a franchise to install an electric light and power system here will be submitted to a vote.

BELLE PLAIN, KAN.—At an election to be held Oct. 15 the proposition to issue $35,000 in bonds for the installation of a municipal electric light plant and water-works system will be submitted to a vote. Preliminary plans for the proposed plants have been prepared by Rollins & Westover, Midland Building, Kansas City, Mo., the engineers.

CHENEY, KAN.—The Council has engaged Rollins & Westover, Midland Building, Kansas City, Mo., to prepare plans for the proposed water and lighting plant, to cost approximately $30,000. A proposition to issue bonds for the project will be submitted to the voters.

MULBERRY, KAN.—A petition is being circulated asking the Mayor and Council to call an election to vote on the proposition of establishing a municipal electric-light plant and water-works system.

SOLOMON, KAN.—A petition has been presented to the City Council asking for the installation of an electric-light plant here. The cost of a plant with sufficient output to supply electricity for street, residential and commercial lighting is estimated at $10,000.

CLOVERPORT, KY.—The Cloverport Ice Co. is planning to install an electric-light plant. A. A. Simons is president.

DANVILLE, KY.—The property of the Danville Lt., Pwr. & Trac. Co. has been purchased by H. C. Wood. The new owner proposes to enlarge the plant and make improvements to the system.

EDDYVILLE, KY.—Plans are under way for reorganizing the management and operation of the municipal electric light and power plant and for an extension of the street-lighting system.

MOUNT VERNON, KY.—J. E. Shoop, of Danville, Ky., is planning to install an electric light plant in Mount Vernon.

PERRYVILLE, KY.—Plans are being prepared by W. J. DeBaun, of Perryville, for the construction of an electric light and power plant here in connection with his creamery and ice factory.

BREAUX BRIDGE, LA.—At a special election held recently the proposition to grant the Louisiana El. Ry. & Pwr. Co., of Lafayette, a franchise to construct and operate an electric railway in this parish was carried.

SYKESVILLE, MD.—The contract for erection of an electric transmission line from the Springfield State Hospital electric plant to Sykesville has been awarded to the Marriottsville Construction Co., Marriottsville, Md.

AMESBURY, MASS.—The town has accepted the proposition submitted by the Amesbury El. Lt. Co. to supply electricity for operating the municipal electric-light system for a period of 10 years. The company also offered to furnish power to operate the pumping station of the water-works system. The city has decided to operate the pumping plant for three months on trial to find the actual cost of pumping the city water.

BOSTON, MASS.—Bids will be received by the trustees of the Consumptives' Hospital of Boston, 926 Tremont Building, Boston, until Oct. 4, for electrical work for Children's Hospital, River Street, Mattapan, Boston. Bids must be made on form obtained at the office of Hollis, French & Allen Hubbard, engineers, 88 Pearl Street, Boston. Edward F. McSweeney is chairman of board.

CHICOPEE, MASS.—The Board of Aldermen has passed over the veto of Mayor Rivers the ordinance allowing the Amherst Pwr. Co. a franchise to furnish electricity in Chicopee.

ENFIELD, MASS.—The Central Massachusetts El. Co., Palmer, has submitted a proposition to the Board of Selectmen for lighting the streets of the town.

PRINCETON, MASS.—At a town meeting held recently the citizens voted to appropriate $15,000 for the installation of a municipal electric-light plant in Princeton.

SALEM, MASS.—Sealed proposals will be received until Oct. 7 at the office of Hartwell, Richardson & Driver, architects, 62 Devonshire Street, Boston, Mass., for complete electrical installation for the proposed Practice School, State Normal School, Salem, in accordance with drawings and specifications, which may be seen at the office of the Richard D. Kimball Co., engineers, 6 Beacon Street, Boston, Mass.

WINCHENDON, MASS.—The Massachusetts Northern Rys. Co., Greenfield, is planning to install a rotary converter in its Winchendon power house to furnish power for its new line from Baldwinville to Winchendon.

ANN ARBOR, MICH.—Bids will be received until Oct. 14 for the installation of a new power plant at the University of Michigan. Shurley W. S. Smith is secretary.

DETROIT, MICH.—The Chalmers Motor Car Co. is erecting a power plant. Albert Kah, 58 Lafayette Avenue, Detroit, is architect.

GRAND RAPIDS, MICH.—At an election held recently it was voted to authorize the Board of Public Works to make investigations as to how much power can be developed from a dam across the Grand River and the cost of same.

HOLLY, MICH.—Upon being granted a franchise the Independent Pwr. Co. will build and operate an electric railway from Pontiac to Owosso, passing through Holly, Fenton, Linton, Gaines and Durand. The company owns and operates a number of electric-lighting plants along the Shiawassa River and has dams at Byron, Linden and Holly. George C. Weber, of Linden, is head of the new enterprise.

KALAMAZOO, MICH.—The Bayston Paper Mills Co. will erect a power plant, contracts for which have been awarded to C. R. Meyers & Son, Oshkosh, Wis.

MARQUETTE, MICH.—Arrangements are being made to equip the municipal water-works pumping station with electrically operated machinery. Contracts for machinery have been placed and work on installation will begin Nov. 1. Electricity for operating the pumps will be furnished by the municipal electric-light plant. The steam plant will be held for use in emergencies.

MOUNT CLEMENS, MICH.—The City Council has decided to change

the present system of street lighting, by means of 78 festoons of lamps extending from one side of the street to the other, to the cluster-lamp system. The public lighting committee has charge of the matter.

NEGAUNEE, MICH.—The City Council has decided to enter into a contract with the Cleveland Cliffs Iron Co. for electrical energy to operate the municipal electric-light system.

NILES. MICH.—The Kawneer Mfg. Co. is planning to build an independent electric power plant to supply electricity for lamps and motors for its factory.

OWOSSO, MICH.—The Union Tel. Co. has rejected all bids for construction of its new building. The work will be readvertised.

RICHMOND, MICH.—At a special election held Sept. 16 the proposition to sell the municipal electric-light plant to the Eastern Michigan Edison Co., Detroit, was carried. The amount paid for the plant was $18,000. A 24-hour lighting service will be established and a day power service furnished.

ST. CLAIR HEIGHTS, MICH.—Negotiations are under way between the Village Council and the Peninsular Lt. Co., of Detroit, for the renewal of the street-lighting contract. The company has submitted a proposition offering to install new street lamps under a 10-year contract.

MOORHEAD, MINN.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 21 for furnishing lighting, heating and electrical conduits, wiring and interior lighting fixtures for the federal building at Moorhead.

NEW LONDON, MINN.—At a special election held recently the proposition to install a municipal electric-light plant here was carried.

ST. CLOUD, MINN.—The Public Service Co. has applied to the Board of Commissioners for permission to erect a power line from the dam to the city limits. This line will form a part of the transmission line to be erected through Waite Park, Rockville, Cold Springs and Richmond.

BEVIER, MO.—At an election to be held Oct. 8 the proposition to issue $11,000 in bonds for the purchase of the plant of the Bevier El. Lt. & Pwr. Co., to be owned and operated by the municipality, will be submitted to a vote.

MARYVILLE, MO.—The Maryville Lt. & Pwr. Co. has been granted a franchise for municipal heating. Steam from its power boilers will be utilized to heat the business section of the city.

ST. CHARLES, MO.—Application has been made to the City Council by the Mississippi River Pwr. Co. for a franchise to distribute electricity in this city.

DARBY, MONT.—Steps have been taken by the Commercial Club to secure the establishment of an electric-light plant in Darby.

HILGER, MONT.—The Kendall Lt. & Pwr. Co. has applied to the County Commissioners for a franchise to erect a transmission line from its power plant in Warm Springs Creek to Hilger. H. Lang is superintendent of the company.

GENOA, NEB.—The Nebraska Pwr. Co., which proposes to develop ultimately over 150,000 hp by diverting water from the Loup River through a canal to a series of power plants with heads varying from 90 ft. to 150 ft., is now building a small plant at Genoa. W. J. Eatherton is engineer. H. L. Doherty, of New York, is interested in the project.

KEARNEY, NEB.—The City Council has notified the Kearney Wtr. & El. Co. that it must terminate its city lighting business by Dec. 1 and after that time its poles and wires must be removed from the streets and alleys of the city. The Council will engage an engineer to prepare plans for a municipal electric-light plant, for which bonds were voted some time ago.

MANHATTAN, NEV.—A H. Crampton, who has a lease of the property of the Manhattan Mining Co., is planning to install an electric hoist.

RENO, NEV.—The Pacific Tel. & Teleg. Co. will soon begin work on the construction of a new exchange plant and office building here, to cost $75,000.

LEBANON, N. H.—Plans are being considered for organizing a holding company, to be known as the Grafton County El. Co., for the purpose of controlling the local plant and two plants between here and West Lebanon. It is proposed to expend immediately $45,000 for improvements to the down-river plants and $8,000 to the plant in Lebanon. George S. Rogers is president of the Lebanon El. Lt. & Pwr. Co.

ALBUQUERQUE, N. M.—D. C. Collier, of San Diego, Cal., and associates, who recently purchased a large tract of land near here, are planning to build a large dam for the purpose of creating a large storage reservoir and also to install a hydroelectric power plant. It is proposed to colonize the tract with farmers.

ANTWERP, N. Y.—Preparations are being made by F. X. Baumert & Co. for the construction of a concrete power house at its cheese factory in Antwerp. The equipment will include a 200-hp boiler, for which contract has been awarded. A 135-hp steam turbine generator will also be installed.

BINGHAMTON, N. Y.—The proposition for the county to install an ornamental lighting system in Court House Square will be submitted to the Board of Supervisors on Oct. 19. It is proposed to erect about 20 ornamental lamp standards, each carrying three large incandescent lamps. The cost is estimated at about $2,500.

BROOKLYN, N. Y.—Plans have been filed with the Building Department by the Edison El. Illg. Co. for the construction of a concrete and steel power house, to be located in Jay Street, near Front Street, which will be used partly to generate electricity for the Manhattan Bridge Three-Cent Line

BROOKLYN, N. Y.—The contract for installing electric equipment in Public School 173, Brooklyn, has been awarded to the Anderson-Martin El. Co., 1 Madison Avenue, New York, for $10,459.

BUFFALO, N. Y.—Proposals will be received by the Commissioner of Public Works, Room 5, Municipal Building, Buffalo, until Oct. 5 for furnishing labor and material for remodeling the building formerly known as the Buffalo Orphan Asylum, located at the corner of Virginia and Morgan Streets, to be used for the temporary accommodation of the Masten Park High School. A separate and distinct proposal must be made for each of the following divisions of the work: (a) Masonry, ironwork, plastering, roofing, painting, glazing, hardware, etc.; (b) electrical work, generators, switchboards, motors, lighting fixtures, etc.; (c) heating, radiation, etc.; (d) plumbing, gas-fitting, etc. Plans and specifications are on file at the office of the deputy building commissioner, Room 6, Municipal Building, where blank forms of proposals may be obtained. Francis G. Ward is commissioner of public works.

CARTHAGE, N. Y.—The plant and holdings of the Carthage El. Lt. & Pwr. Co. have been purchased by J. B. Taylor, of Watertown. It is said that Mr. Taylor proposes to double the output of the Belfort plant.

CLAYTON, N. Y.—Application has been made to the Board of Village Trustees by John B. Taylor, of Watertown, for a franchise to supply electricity for lamps and motors here.

COMSTOCK, N. Y.—The contract for electrical work for the new cell building at Comstock has been awarded to Isador Fajans, 122 East Twenty-fifth Street, New York, for $7,985.

FLUSHING, N. Y.—Preparations are being made by the Long Island R. R. Co. for the construction of an electrical substation on Barclay Street. This station will supply electricity to operate the North Shore road.

JOHNSTOWN, N. Y.—The Council has awarded the contract for street lighting to the Fulton County Gas & El. Co for a period of five years beginning May 1, 1913. Under the terms of the contract the company will furnish 110 or more arc lamps at the rate of $59 each per year and 75 or more 40-watt incandescent lamps at $14.50 each per annum.

NIAGARA FALLS, N. Y.—Richard Crick, president of the Business Men's Association, has been authorized to engage a hydroelectrical engineer to prepare plans for the construction of a municipal electric-light plant.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until Sept. 30 for installing electric equipment necessitated by the addition to and alterations in Public School 72, on Lexington Avenue, between 105th and 106th Streets, and for installing electric equipment in Public School 76, Lexington Avenue and Sixty-eighth Street, borough of Manhattan. Blank forms, plans and specifications may be obtained at the above office.

SARATOGA, N. Y.—The Adirondack Pwr. Corpn. has appropriated $500,000 for extensive improvements to its plant at Spier Falls and throughout its territory. Among the improvements will be the erection of a new steel tower transmission line between Mechanicsville and Ballston, which will be merged with the Albany transmission line.

SCHENECTADY, N. Y.—Bids will be received by B. A. Farrell, clerk of board, Schenectady, until Oct. 1 for furnishing and installing electric-light and gas fixtures in the county court house.

SPRINGVILLE, N. Y.—Bonds to the amount of $8,000 have been voted for the installation of an electric generator and gas engine and other equipment in the municipal electric-light plant.

GLEN ULLIN, N. D.—A site has been secured for the proposed electric-light plant and work will be started at once on construction of building.

ATHENS, OHIO.—Sealed proposals will be received by the Board of Trustees of the Ohio University, Athens, Ohio, until Oct. 18, for furnishing materials and labor necessary for extension of heating plant and electrical conduits in accordance with plans and specifications prepared by Frank L. Packard, architect, Columbus, Ohio, which are on file at the office of I. M. Foster, secretary of board of trustees, Athens, and at the office of the architect, New Hayden Building, Columbus. Alston Ellis is president of the board of trustees.

CINCINNATI, OHIO.—The Cincinnati Trac. Co. contemplates extensive improvements to its system, involving an expenditure of about $3,000,000. Work will begin at once on the belt line, which is to be known as the Elberon-Warsaw line and which is to connect two routes in Cincinnati.

CLEVELAND, OHIO.—The Public Service Commission has granted the Cleveland Ry. Co. permission to issue $3,015,000 in capital stock, the proceeds to be used for increasing power plant facilities and other improvements.

CLEVELAND, OHIO.—Sealed proposals will be received at the office of W. H. Kirby, secretary to the director of public safety, 104 City Hall, Cleveland, until Oct. 8 for six 1000-hp water-tube boilers for the municipal electric-light plant. W. J. Springborn is director of public safety.

COLUMBUS, OHIO.—The Northwestern Ohio Ry. & Pwr. Co. has been granted permission by the Public Service Commission to issue

$105,000 in bonds for improvements and betterments. About $70,000 will be used for enlarging its power plant and the rest for purchase of cars.

DAYTON, OHIO.—The Dayton, Covington & Piqua Trac. Co. has decided to extend its railway from Covington to Bradford and thence to Loramie if possible. The company has applied to the Public Service Commission for permission to issue $400,000 in bonds.

EDGERTON, OHIO.—The Town Council has awarded E. A. Geauque, owner of the local electric-light plant, a 10-year contract for street lighting. The new contract calls for 84 tungsten lamps of 32 cp. Iron posts will be used and the wires placed underground.

GREENFIELD, OHIO.—It is reported that Cleveland capitalists are interested in a hydroelectric development of about 5000 hp, near Greenfield. Transmission lines will be erected to Hillsboro, Wilmington, Washington C. H., Circleville, Chillicothe and intervening towns.

SALINEVILLE, OHIO.—The Salineville El. Lt., Ht. & Pwr. Co. is planning to rebuild its plant, recently destroyed by fire.

TOLEDO, OHIO.—Bids will be received at the office of the director of public safety, Toledo, until Oct. 1 for the purchase of approximately 5000 ft. of 13 conductor cable and 400 ft. of submarine cable, according to specifications on file at the office of the superintendent of fire and police alarm telegraph, fire department headquarters, Jefferson Avenue and Ontario Street. J. J. Mooney is director of public safety.

ALTUS, OKLA.—The proposition to sell the municipal electric-light and power plant to John C. Keys, of Oklahoma City, for $35,000, and to grant him a 21-year franchise, was defeated.

TULSA, OKLA.—The Sands Springs Interurban Ry. Co. is planning to build an electric railway from Tulsa to Nowata, via Owasso and Collinsville, a distance of about 45 miles.

PORTLAND, ORE.—The Northwestern El. Co. has commenced work on the power plant to be installed on the White Salmon River in the State of Washington, about 3 miles from where the stream empties into the Columbia River. The dam is to be built of concrete and to be 125 ft. high and 450 ft. long.

SALEM, ORE.—The state engineer has granted the application of George T. Holcomb to appropriate 1000 second-ft. of water of the Clackamas River, to be used for power purposes. D. P. Donovan, of Payette, was also given permission to appropriate 1000 ft. from the same river for power purposes.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Dec. 25 for furnishing miscellaneous electrical supplies. Major F. C. Boggs is purchasing officer.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer of the Isthmian Canal, Washington, D. C., until Oct. 5 for furnishing miscellaneous electrical material for power and control wiring, including special cable-end bells, lead splicing sleeves, copper sleeve connectors, insulating tapes, solder, soldering flux, filling compound for end bells and joints, cable pulling grips, etc. Blanks and general information pertaining to this circular (No. 734) may be obtained at this office or at the offices of the assistant purchasing agents, 24 State Street, New York, and 614 Whitney Central Building, New Orleans, La. Major F. C. Boggs is purchasing officer.

ALTOONA, PA.—The South Fork-Portage Ry. Co., recently organized with a capital stock of $48,000, will furnish electricity for power purposes. Charles H. Morgan is interested.

DRAVOSBURG, PA.—The Clairton & Blair El. St. Ry. Co. and the Pine Run St. Ry. Co. have been consolidated under the name of the McKeesport & Clairton Rys. Co. Preliminary steps have been taken toward construction of the railway. James E. White and associates are interested.

EL PASO, TEX.—The Board of Aldermen has authorized the El Paso El. Ry. Co. to place arc lamps on many street corners in the city.

NORTH WALES, PA.—The property of the E. K. Freed El. Lt. Co., of North Wales, has been purchased by W. W. Levering, of Philadelphia. The company supplies electricity for lamps and motors in North Wales and surrounding towns in Upper and Lower Gwynedd Townships. The company has been reorganized with Mr. Levering as president and Franklin S. Kreibel secretary and treasurer.

PHILADELPHIA, PA.—Plans are being considered by Mayor Blankenburg to enforce the ordinance requiring all overhead wires to be placed underground. An appropriation of $10,000 for renewal of poles owned by the city will be recommended by the Mayor. A request for an appropriation to place the city-owned wires underground will be included in the maintenance budget of the Electrical Bureau next year.

PITTSBURGH, PA.—Electric equipment will be used almost exclusively in the new coal mines of the United States Coal Co. The company has taken over 2300 acres of deep vein coal in the Kemmer district, Wyo. The offices of the company are located in the First National Bank Building, Pittsburgh.

SELLERSVILLE, PA.—The capital stock of the Excelsior El. Lt., Pwr. & Gas Co. has been increased from $30,000 to $50,000. The office of the company is located at 412 Commonwealth Building, Philadelphia, Pa.

UPPER DARBY, PA.—The Philadelphia & West Chester Trac. Co. is planning to build a new substation in Upper Darby.

EAST PROVIDENCE, R. I.—The Narragansett El. Ltg. Co. has submitted a proposition to the Council offering to change the present 32-cp incandescent lamps for 60-cp lamps and to replace the present arc lamps with new magnetite-arc lamps. The change will cost the town $1,000 per year additional. The proposition will be submitted to the voters at the November election.

PROVIDENCE, R. I.—The city engineer's department has granted the request of the Connecticut River Pwr. Co. to submit an estimate of the cost of operating pumping stations of the municipal water-works system by electricity.

PROVIDENCE, R. I.—Plans have been completed by R. L. Burnet, electrical engineer, for the redistribution of electric lamps on Exchange Place and the business section of the city, and plans for the redistribution of lamps in the Roger Williams district, which will eventually be extended through other sections of the city, are being prepared. The change in the illumination will, when completed, call for replacing 934 Welsbach gas lamps, 1950 open-arc lamps and 2684 incandescent lamps by 600 magnetite-arc lamps fed by overhead wires, 800 arc lamps fed by underground wires and 7500 tungsten incandescent lamps.

CUMBERLAND GAP, TENN.—The Town Council is negotiating with the Middlesborough El. Lt. Co., Middlesborough, Ky., for electrical service here. The company desires a franchise in Cumberland Gap and proposes to supply electricity to the Lincoln Memorial University and to the residents of Harrogate, a suburb of Cumberland Gap.

ANNA, TEX.—It is reported that G. I. Wilcox, of Melissa, is contemplating the installation of an electric-light plant here. Energy for operating the system will be secured from the Texas Trac. Co.

CLARENDON, TEX.—The Clarendon El. Lt. & Pwr. Co. is erecting transmission lines to the farming district in this section; improvements are also being made to the lighting system in Clarendon.

DALLAS, TEX.—Extensive improvements are contemplated by the Dallas Automatic Tel. Co. to its system in and around Dallas within six months, which will involve an expenditure of about $500,000. J. C. Casler is president.

ELECTRA, TEX.—The installation of an electric-light plant in Electra is under consideration. S. S. Walker is said to be interested.

FLORESVILLE, TEX.—The City Council has granted a franchise for the installation of an electric-light plant to J. H. Spencer and associates.

HOUSTON, TEX.—A franchise has been granted to Anderson Brothers, of Houston, owners of the Gem El. Co., to operate an electric transmission line over Main Street road from the city limits of Houston out past the Rice Institute, Dr. Greenwood's new sanitarium, and along the south side of Brays Bayou. The line will also be extended over the new street known as University Avenue, lying on the west side of the institute grounds and connecting with Bellaire Boulevard. It is understood that the company will extend its line out on Bellaire Boulevard to supply electricity along that thoroughfare. The company will connect with the city system at Southmore.

PLAINVIEW, TEX.—The capital stock of the Plainview Lt. & Ice Co. has been increased from $30,000 to $60,000, the proceeds to be used for improvements and extensions to its plant.

PLANO, TEX.—The property of the Plano Lt. & Pwr. Co. has been sold to G. A. Wilcox, of Melissa.

TYLER, TEX.—Plants have been prepared by the Tyler Street Car Co. for the construction of an electric power plant here. The company is building the first 5 miles of its electric railway system.

WEST, TEX.—The Southern Trac. Co., Dallas, has been granted a franchise to construct and operate an electric-light plant here.

BINGHAM, UTAH.—Negotiations are under way between the Utah Copper Co. and the Telluride Pwr. Co., whereby the latter will supply electricity to operate the entire works of the copper company. At present the Telluride company supplies it with about 6000 hp. and the rest is generated at the steam plant at Magna. The copper company is negotiating with the new management of the Telluride company for 14,000 hp. As soon as the contract is closed the steam plant at Magna will be closed down, but will be held in readiness for use in emergencies. D. C. Jackling is vice-president and general manager of the Utah company.

BURLINGTON, VT.—The Burlington Trac. Co. is negotiating with the villages along the line between Burlington and Vergennes to furnish electricity for lamps and motors from the Vergennes plant. A 24-hour service will be supplied.

COLONIAL BEACH, VA.—The city is planning to install an electric-light plant to be operated in connection with the water-works system. H. W. B. Williams is Mayor.

BREMERTON, WASH.—The City Council has decided to have plans prepared for the construction of a municipal lighting and power plant, to cost about $25,000.

SEATTLE, WASH.—Plans have been prepared by the Puget Sound Trac., Lt. & Pwr. Co for the erection of a steel boiler house at Duwamish Avenue.

SEATTLE, WASH.—Plans are being prepared by Edgar Blair, school architect, for a power, lighting and heating plant for the Mercer High Parental School, to cost about $20,000.

SPOKANE, WASH.—Announcement has been made by the Inland Underwriters, Eagle Building, Spokane, that plans have been completed for the light and power plant of the Waneta Devel. Co., bids for which will be called in the near future. The cost of the plant is estimated at about $30,000.

WALLA WALLA, WASH.—The property and holdings of the Burbank Pwr. & Wtr. Co. have been purchased by the Sanderson & Porter Co., of New York, N. Y., for $60,000. It is stated that a new power plant and new canals will be constructed at a cost of about $400,000.

COON VALLEY, WIS.—Thompson Brothers are installing an electric-light plant in Coon Valley. Material for the plant has been purchased.

EDGERTON, WIS.—The business men are planning to install an ornamental street-lighting system in the business district. The installation of 15 ornamental lamp standards carrying five-lamp clusters is under consideration.

RACINE, WIS.—The business men have decided to install a new street-lighting system in the business district in Columbia Corners. It is proposed to erect seven large arches over the street carrying incandescent tungsten lamps.

EDSON, ALTA., CAN.—At an election held recently the ratepayers voted in favor of by-laws authorizing the installation of a fire-alarm system to cost $5,000, electric-light plant and water-works system, to cost $65,000, and erection of city hall, to cost $20,000.

DUNCANS, B. C., CAN.—The ratepayers have voted in favor of the by-law authorizing an expenditure of $100,000 for extensions to the municipal power plant and water-works system. Tenders for the work will soon be called for. The Dutcher, Maxwell Co., 319 Pender Street, West, Vancouver, B. C., has charge of the engineering work.

KAMLOOPS, B. C., CAN.—Petitions have been received by the City Council from the ratepayers for the submission of three by-laws to the ratepayers as follows. To appropriate $250,000 for a hydroelectric power plant, $65,000 for improvements and extensions to the municipal electric-lighting system and $90,000 for extensions and improvements to the municipal water-works system.

PORT ALBERNI, B. C., CAN.—Anderson, Warden & Wilkin, Williams Building, Vancouver, have been engaged to prepare plans for an electric power plant and electric distributing system for this city.

VANCOUVER, B. C., CAN.—The Canadian Pacific Ry. Co. announces that work will begin this year on the construction of a tunnel 8 miles long through the Rocky Mountains. The tunnel will cost about $9,000,000, and trains will be operated by electricity through the tunnels.

WINNIPEG, MAN., CAN.—The by-law authorizing the Council to expend $750,000 on an electric distributing system has been indorsed by the ratepayers.

BERLIN, ONT., CAN.—The Canadian Consol. Rubber Co. has requested the Berlin Light Commission to submit estimates for furnishing the company with hydroelectric power to the amount of 2280 hp. to operate its factory now in course of construction. In order to provide this service it will be necessary not only to enlarge the local power plant but also the substation of the Hydro-Electric Power Commission.

ELMIRA, ONT., CAN.—Steps have been taken by the Board of Trade to secure electrical service from the Hydro-Electric Commission. In order to furnish the service the erection of a transmission line 10 miles long will be necessary. A movement has been started in St. Jacobs to interest the ratepayers there with a view of installing a transformer station to supply electricity in St. Jacobs.

GALT, ONT., CAN.—Petitions have been presented to the Hydro-Electric Department of the city of Galt asking for the installation of ornamental street lamps on eight streets, covering about 4 miles.

HAMILTON, ONT., CAN.—Sealed tenders will be received by George H. Lees, Mayor, chairman of Board of Control, Hamilton, until Oct. 7, for various works required in the erection of electric pumping station at the Hamilton water-works Beach pumping station. Plans and specifications may be seen at the office of W. A. Edwards, Hamilton Provident & Loan Building, Hamilton, where form of tender and other information can be obtained. S. H. Kent is city clerk.

OTTAWA, ONT., CAN.—J. A. Morden and R. J. Percy, of Toronto, are promoting a new railway using gas-electric cars. The new railway will be known as the St. Lawrence Railway and will run from Ottawa to Morrisburg and back to Ottawa, forming a belt line, touching Prescott, Brockville and Arnprior. A branch line will also be built from Morrisburg through Cornwall to the Quebec border. The railway will be about 274 miles long and will cost about $20,000 per mile.

OTTAWA, ONT., CAN.—It is reported that plans are being perfected for equipping the new Hudson Bay Railway for electrical operation. A hydroelectric power plant, it is stated, will probably be constructed at White Mud Falls, which is about halfway between Lake Winnipeg and Hudson Bay. Plans are also being considered for utilizing this great hydroelectric power in the Western provinces under similar regulations to those under which the Ontario Hydroelectric Commission controls the power at Niagara and other locations in the Province of Ontario. Frank Cochrane is president of the Hudson Bay Co.

PORT ARTHUR, ONT., CAN.—At a special election held Sept. 16 the ratepayers voted in favor of by-laws authorizing an extension of the street-railway system easterly to Hedge Siding, to cost $34,000, and the construction of a belt-line railway, at a cost of $82,200; also the extension of the street railway on Queen Street from Algoma Street to High Street, at a cost of $4,300.

SHERBROOKE, QUE., CAN.—The Sherbrooke Ry. & Pwr. Co. contemplates extending its street-railway system to Bromptonville, a distance of 6 miles. N. C. Pilcher is manager of the company.

YORKTON, SASK., CAN.—Sealed tenders will be received by T. F. Atcheson, secretary and treasurer, Yorkton, until Oct. 31 for one 500-hp Diesel engine, direct-connected to alternator and exciter, one switchboard with auxiliary panel and series tungsten street-lighting apparatus. Specifications may be obtained on application to the office of M. M. Inglis, electrical engineer.

New Industrial Companies

THE BELL, BAYERS & WOODBURY COMPANY, of Boston, Mass., has been incorporated with a capital stock of $10,000 by John Bell, Harry I. Bayers and Ronald S. Woodbury. The company proposes to deal in electrical supplies.

THE GAY ELECTRIC CLOCK COMPANY, of Baltimore, Md., has been chartered with a capital stock of $25,000 to manufacture electric clocks. The incorporators are: Herman T. Gay, 1604 Hoffman Street, Baltimore; Joseph Carroll and James Hochrein.

THE JUDSON-McCARTHY-LOWE COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $20,000 for the purpose of doing a general electrical contracting and engineering business. The incorporators are: George E. Judson, Joseph F. McCarthy and William Lowe.

THE K. D. ELECTRIC WATER-HEATER COMPANY, of San Francisco, Cal., has been incorporated with a capital stock of $300,000 by E. L. Braswell, L. Gardella and E. R. Bellew.

THE NEW ENGLAND ELECTRO-CHEMICAL COMPANY, of Portland, Maine, has been incorporated by Albert T. Jones, T. L. Croteau and Albert A. Richards. The company is capitalized at $5,000,000.

THE NEW YORK ELECTRIC SIGN COMPANY, of New York, N. Y., has been incorporated by William Abrahamson, Howard A. Scholle, of New York, and A. Ehrlich, of Brooklyn. The company is capitalized at $25,000 and proposes to furnish electric signs.

THE PALMER ELECTRIC & MANUFACTURING COMPANY, of Kittery, Maine, has been incorporated with a capital stock of $50,000 by Horace Mitchell, H. A. Paul and M. G. Mitchell, of Kittery. The company proposes to deal in mechanical implements and electrical supplies, apparatus, etc.

New Incorporations

SAN DIEGO, CAL.—The Mission Pwr. Co. has been incorporated with a capital stock of $50,000 by William Rose, J. H. Richey and A. Jones. Mr. Jones is the inventor of an electric generator which the company will use at its plant at False Bay, near San Diego.

SAN FRANCISCO, CAL.—The Presto Electric Company has been incorporated with a capital stock of $500,000 by S. A. Fairchild, M. Meagher, E. Barats, S. J. Brun and J. W. Schmitz.

INDIANAPOLIS, IND.—The Merchants' Public Utilities Co. has been incorporated with a capital stock of $4,000,000. It will be a holding company for the Merchants' Ht. & Lt. Co. A bond issue of $6,000,000 has been authorized. The incorporators are: Edward L. McKee, C. M. Polen, H. H. Hornbrook, Albert Smith and Walter S. Glass.

MAQUOKETA, IA.—Articles of incorporation have been filed for the Eastern Iowa Lt. & Pwr. Co., with a capital stock of $500,000, by Elmer G. Fuller and W. C. Hill, of Pierre, S. D.

YARMOUTH, MAINE.—The Yarmouth Ltg. Co. has been incorporated with a capital stock of $70,000 to supply gas or electricity for lamps, heat and motors in Yarmouth, North Yarmouth, Pownal, Freeport, Gray and New Gloucester. The officers are: H. L. Cram, president, and M. P. Lufkin, treasurer, both of Portland.

CHESANING, MICH.—The Advance El. Co. has been organized by Myron E. Coryell and others for the purpose of installing and operating isolated electric light and power plants.

NEW YORK, N. Y.—The Dow-Jones Trans. Co. has been incorporated by Clarence W. Barron, Jessie M. Barron, Hugh Bancroft, Langdon P. Marvin, J. W. Bancroft, H. Wendell Endicott and Joseph Cashman. The company is capitalized at $10,000 and proposes to operate electric, telephone and telegraph lines.

HAMILTON, OHIO.—The Hamilton Utilities Co. has been chartered with a capital stock of $850,000 for the purpose of operating artificial-gas and electric plants. The incorporators are: J. C. Thomas, J. M. Hutton and W. Schmitt.

KINGSTREE, S. C.—Articles of incorporation have been filed for the Kingstree El. Lt. & Ice Co., with a capital stock of $15,000, by P. G. Gourdon, D. C. Scott, Jr., R. H. Kellahan and M. F. Keller.

SWEETWATER, TEX.—The West Texas El. Co. has been incorporated by J. D. Oliger, Walter Graner, H. I. Gehagan, J. D. Caldwell and G. H. White. The company is capitalized at $360,000 and proposes to supply electricity and gas in Jones, Taylor, Fisher, Nolan, Scurry, Mitchell, Howard and Runnels Counties.

YACOLT, WASH.—The Northern Clark County Lt. & Pwr. Co. has been incorporated with a capital stock of $15,000 by C. R. Miller and others.

Trade Publications

TRANSFORMERS.—A miniature of Bulletin 99 has been issued by the Wagner Electric Manufacturing Company, St. Louis, Mo., which refers to transformers. Considerable information, fully illustrated, is given in this miniature publication.

DIRECT-CURRENT MOTORS.—Westinghouse commutating-pole, direct-current motors (Type QM) for compressors, blowers, pumps and similar classes of service are fully illustrated and described in Leaflet No. 2499, recently published by the Westinghouse Electric & Manufacturing Company.

GENERATORS.—The Crocker-Wheeler Company, Ampere, N. J., has recently distributed Bulletin No. 153, which supersedes No. 119 on the same subject. It is devoted to direct-current generators with ratings from 200 kw to 1500 kw. The constructive features are given in detail, with illustrations of typical installations in numerous industrial plants throughout the country.

ELECTRIC TRUCKS.—The General Vehicle Company, Long Island City, N. Y., has distributed an eight-page folder, the subject of which is "Hot Weatherisms on G. V. Electric Trucks." Comparisons between the electric truck and the horse are given in a clear, terse manner, and convincingly demonstrate the advantage of the electric truck over the horse-drawn vehicle. The statement that twenty-five customers have already purchased 791 G. V. trucks excites attention.

MECHANICAL DRAFT.—The American Blower Company, Detroit, Mich., has issued Publication No. 343, which refers to mechanical draft, forced and induced, using "Sirocco" and "A B C" blowers and exhaust fans. The subject matter is fully illustrated and is treated in a broad, comprehensive manner that will interest and instruct every prospective user of this class of apparatus. The publication calls particular attention to the natural advantages realized with artificial draft produced by mechanical means and shows photographs of actual installations, thus making clear to those interested the various methods of applying draft fans to steam boilers. There are chapters on economical power production, principles governing combustion, draft-creating appliances and a large variety of other general information. Tables showing the properties of coal, steam and air occupy the last six pages of this sixty-four-page catalog.

HOISTING MACHINERY.—The Lidgerwood Manufacturing Company, 96 Liberty Street, New York, has issued a handsome 9⅛-in. x 11¾-in. catalog on its derricks and hoisting engines. Present and prospective users of such equipment cannot fail to be interested in the contents of this catalog. Lidgerwood derrick irons are made under the patents of Edward F. Terry. The use of a universal ball and socket connection between the mast step and a foot block is one of the main features. Many minor changes have been introduced in the design of the foot blocks, mast steps, masthead irons, goosenecks and spider plates, all of which are fully illustrated in this catalog. All the standard styles of steam and electric hoists used for derrick work are illustrated, described and tabulated. The twenty pages illustrating installations, showing Lidgerwood derricks in use on the Woolworth Building, the New York Post Office and other important buildings, form a very attractive part of this excellent publication.

Business Notes

THE PARKER-CLARK ELECTRIC COMPANY, manufacturer of electrically heated devices, will be known hereafter as the Helion Electric Company, the office and factory remaining at Newark, N. J.

MR. GEORGE W. CONOVER, an experienced electrical business man of Chicago, has established the Buyers' Exchange, with office at 122 South Michigan Avenue, Chicago, to act as a clearing house between buyer and seller of all sorts of commodities, including electrical machinery.

THE EMERSON COMPANY, efficiency engineers, New York, Pittsburgh and Chicago, has published the address of its president, Mr. Harrington Emerson, "Educational Demands of Modern Progress," which was given before the Society for the Promotion of Engineering Education at its recent convention in Boston. The great value of initiative is emphasized by the author, who has handled his theme in a thoughtful and pleasing manner.

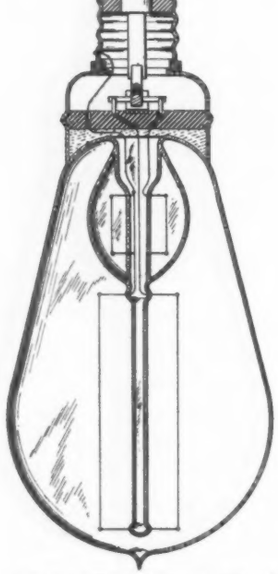
Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 17, 1912.

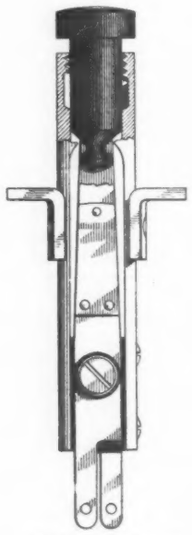
[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,038,567. ELECTRICAL SWITCH; M. D. Greengard, New York, N. Y. App. filed Oct. 14, 1910. For electrolier cluster.

1,038,594. BURGLAR-ALARM SYSTEM; M. F. Juruick, New York, N. Y. App. filed Aug. 16, 1907. Both electrical and mechanical bell-ringing means; for instance, for bank vaults.



1,038,681.—Incandescent Electric Lamp.



1,038,776.—Plunger Switch.

1,038,604. PROCESS OF ELECTRIC WELDING; L. S. Lachman, New York, N. Y. App. filed May 8, 1907. Small welding pieces are interposed at the joint.

1,038,605. COMPOSITE SYSTEM; O. T. Lademan, Milwaukee, Wis. App filed Feb. 15, 1909. Telephone and telegraph for railway service, etc.

1,038,610. ELECTROMAGNET; D. L. Lindquist, Yonkers, N. Y. App. filed Feb. 13, 1909. Alternating-current magnet with a sustable armature

1,038,613. METAL-FILAMENT INCANDESCENT LAMP; G. Lüdecke, Augsburg, Germany. App. filed March 20, 1909. The carrying frame is elastically supported.

1,038,614. ELECTRIC MELTING FURNACE; W. D. Ludwick, Tacoma, Wash. App. filed Jan. 9, 1911. Rotary-hearth type for smelting iron-ore sand.

1,038,617. TELEPHONE EXCHANGE SYSTEM; R. H. Manson, Elyria, Ohio. App. filed May 22, 1906. Trunk ringing.

1,038,659. ELECTRIC METERING APPARATUS; F. W. Roller, East Orange, N. J. App. filed Jan. 19, 1911. Reversible motor type for automobiles, etc.

1,038,663. DOOR LOCK; G. Sahmer, Strassburg, Germany. App. filed Oct. 5, 1911. Electric release for a door latch.

1,038,681. INCANDESCENT ELECTRIC LAMP; E. H. Tate, Los Angeles, Cal. App. filed Sept. 21, 1911. Multiple-filament turn-down type.

1,038,775. INDUCTION MOTOR; B. McCollum, Washington, D. C. App. filed March 3, 1911. The heat of the starting gives a temporary resistance for increased starting torque.

1,038,776. PLUNGER SWITCH; E. S. McLarn, New York, N. Y. App. filed March 16, 1909. Multiple spring-jack type with special plunger mounting.

1,038,827. REFRACTORY ARTICLE AND PROCESS OF MAKING IT; F. M. Becket, Niagara Falls, N. Y. App. filed June 23, 1911. Furnace lining with titanium-carbide surface.

1,038,832. RAILWAY TELEPHONE; D. D. Biggers, May, Oklahoma. App. filed May 27, 1911. Third-rail and current collector.

1,038,861. ALTERNATING-CURRENT COMMUTATOR DYNAMO-ELECTRIC MACHINE; W. Doinikoff, Karlsruhe, Germany. App. filed March 6, 1908. To prevent sparking at the brushes of compensated single-phase machines.

1,038,910. RELAY FOR UNDULATORY CURRENTS; R. von Lieben and E. Reise, Viennia, Austria-Hungary. App. filed Jan. 30, 1911. Vacuum discharge tube with a partition.

1,038,940. COMBINED SWITCH AND TAP-OFF; W. J. Newton, New York, N. Y. App. filed March 4, 1911. Push-button, wall type.

1,038,963. COVER FOR ELECTRIC SWITCH BOXES; H. B. Roe, Pittsburgh, Pa. App. filed Dec. 13, 1909. Adjustable cover for flush boxes.

1,038,990. SWITCH FOR ALTERNATING-CURRENT MACHINES; F. W. Trefry, Pittsburgh, Pa. App. filed Nov. 25, 1911. Motor-driven switch for elevator service.

1,038,995. ELECTRIC SWITCH; A. F. Wallbillich, Bridgeport, Conn. App. filed Aug. 18, 1911. Rotary snap escapement.

1,038,997. TELEPHONE SYSTEM; H. G. Webster, Chicago, Ill. App. filed March 19, 1909. Circuits and apparatus for ringing.

1,039,011. CURRENT INTERRUPTER; E. S. Beck, Treichlers, Pa. App. filed June 2, 1911. Electrodes of copper and iron.

1,039,039. PUSH-BUTTON; W. B. Eicholtz, New Orleans, La. App. filed March 15, 1911. For street-car signal-bell circuit, etc.